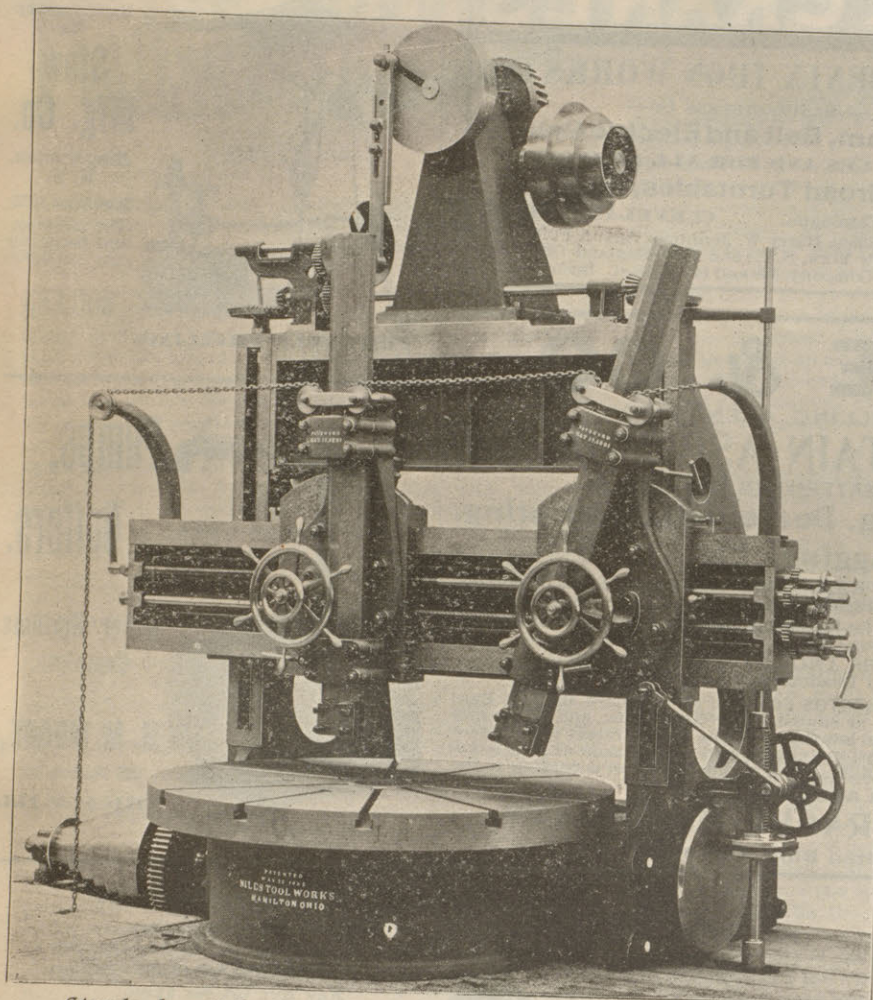


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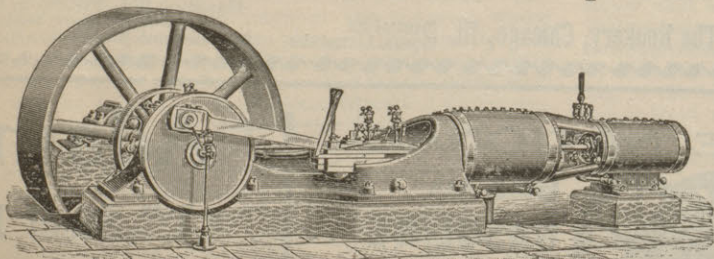
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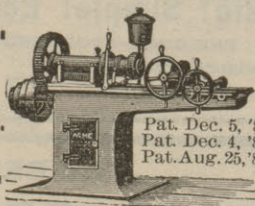
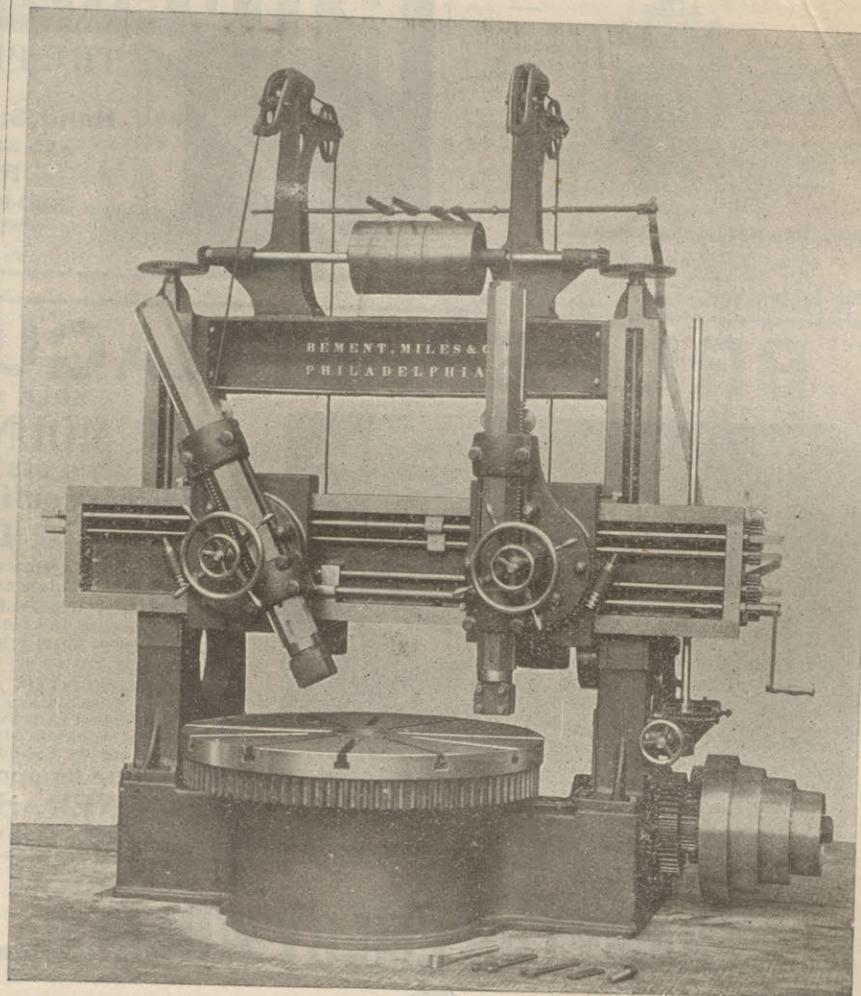
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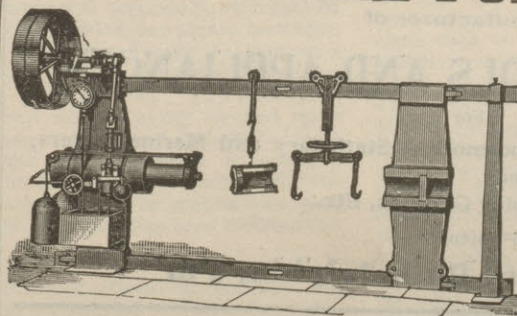
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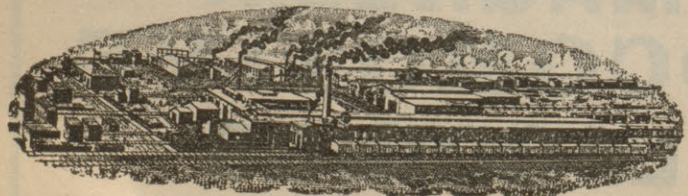
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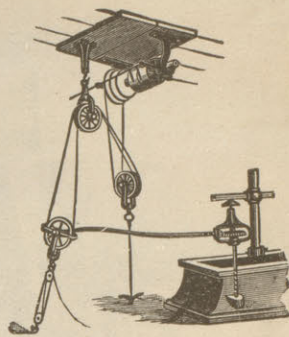
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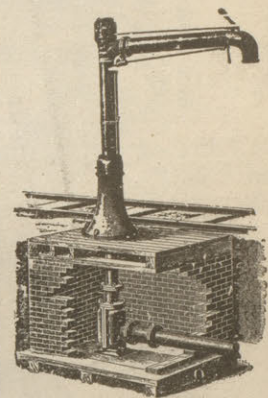
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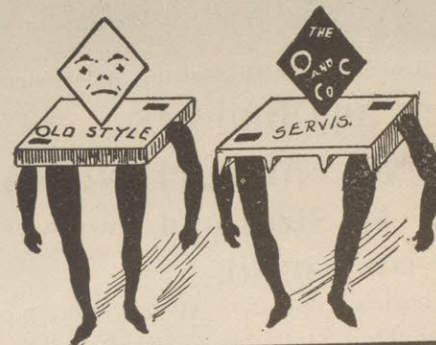
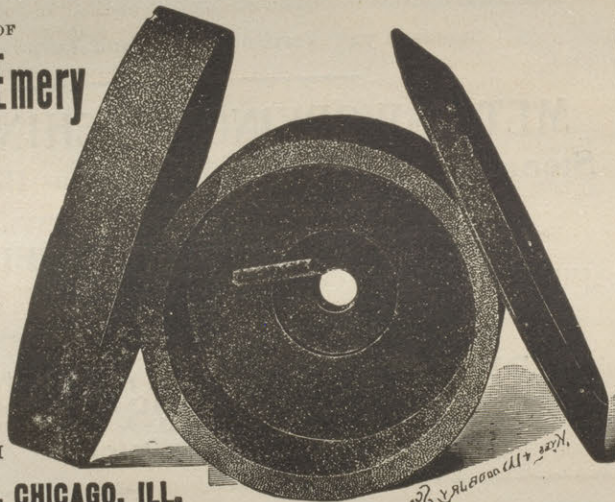
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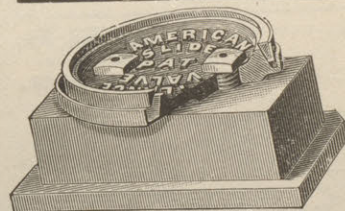
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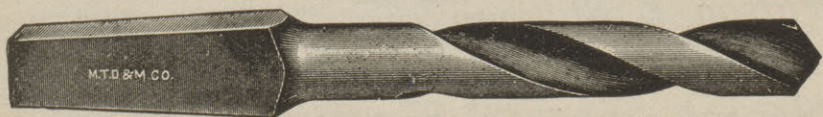
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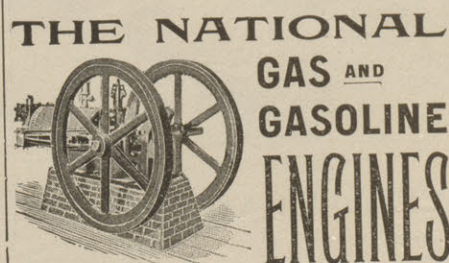
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THE RAILWAY REVIEW

XXXVI.

MAY 23, 1896.

No. 21.

FOOD FOR REFLECTION.—Referring to the nail trust or pool covering the United States and Canada, the *Monetary Times* (Toronto) remarks that when the discovery of its existence was made, the usual protestations of the perfect harmlessness of the combination were offered in defense. However satisfactory the arrangements may be to the operators, consumers are beginning to complain that while the makers were charging \$2.55 for wire nails, and \$2.30 per keg for cut nails, they were selling in Europe for \$1 less than in the United States. One result of this discrimination was that nails were purchased for exportation, shipped across the Atlantic and then shipped back again; and after paying 40 cents, 20 cents each way, in freights across the Atlantic and back, they were sold below the price charged by the pool to domestic consumers. The nails in question escaped the payment of the American duty, on account of their American origin, the packages not having been broken on the other side of the Atlantic. The total cost of the returned nails, including all charges, was \$1.90 per keg, at the outside, while nails sold by the pool for domestic use, then cost \$2.45 now, thanks to an increased duty of 15 per cent per keg, since put on by congress, the price is \$2.55 at Pittsburgh. The pool has taken steps to prevent a repetition of this operation by cutting off the supply. The profits of the largest firm in the pool was 27½ per cent in 1895; now its profits reach 30 per cent, on a capital of \$4,000,000. How much water is there in this \$4,000,000 of capital? We have no report of what the Canadian partners have done or are doing.

WORKINGS OF THE CAR FERRY.—Referring to the business of last year the president of the Flint & Pere Marquette road in his annual report notes that to the ability of the steamers and the road to handle the grain products of Wisconsin and the northwest may be attributed the gratifying increase of \$116,165 in gross earnings for the first three months of 1896 over the corresponding months of 1895. The classes of freight, which to the present date the road has been able to handle, have been confined to such articles as could be transferred from car to boat and boat to car. To free the road from its limitation and to secure additional business of a higher class from Wisconsin and the northwest, it is deemed prudent to add to lake equipment a car ferry steamer. With this end in view, arrangements have been made for the construction of a steel ferry with tracks for 30 cars. This boat will be the largest of its class, and it is expected that it will be ready for service during the coming autumn, at which time connections with the rails of the Chicago & Northwestern Railway and the Wisconsin Central Railroad will be made at Manitowoc. Under favorable conditions two round trips a day will be made by this steamer. Arrangements have been concluded with the Ann Arbor Railroad Company for the use of its valuable terminal property in Toledo, and of its right of way and track from Alexis to the city. This will enable the Flint & Pere Marquette Railroad Company to secure, at a moderate outlay, an independent entrance to a large and prosperous city, and a direct connection with the rails of the Columbus, Hocking Valley & Toledo Railroad, Pennsylvania Company, Wheeling & Lake Erie, Lake Shore & Michigan Southern Railway, Michigan Central Railway, and Cincinnati, Jackson & Mackinaw Railway; also with Wheeling and Michigan Central Belt Lines, through which the other railroads centering in Toledo are reached.

APPLICATION OF ELECTRICITY TO THE ERIE CANAL.—Mr. Richard Lamb, the civil engineer and inventor, whose electric bank haulage system was put in operation last year at Tonawanda, has worked out a beautiful and costly model of a system of electric operation for the Erie canal. It will be located at the National Electrical Exposition, as an adjunct to the model of the Niagara power plant, which is to stand in the center of the main floor; and the intention is to run it by some stored power from Niagara, switching over occasionally to the regular circuits of the building. The model is no less than 40 feet in length, 6 feet in height, and about 3 feet wide. The canal will have eight inches depth of water in it. There will be eight poles, five feet apart, and a one-fourth horse-power motor will furnish a more than liberal supply of motive power to a string of three boats. The latest innovation in canal and lake freighting is the use of steel barges, and the owners of these, the Consolidated Canal Company, who now have a large number afloat, have built three small facsimiles of their craft. The model is not strictly to scale, but the boats are. Each is two feet long. They have been dubbed respectively, Hawley, Lamb, and Wiman, as a setting to the view of the Erie Canal, with its miniature equipment of methods old and new, a scenic artist has painted an appropriate background of rural scenery. The whole thing is cleverly worked out, the "tow" going up the canal and back in about two minutes, the motor reversing automatically at each end of the section.

COAL DUST FUEL.—An English journal states that the appliances for firing with coal dust are practically modifications of the apparatus which Thomas R. Crampton constructed in the middle of the sixties. The dust has to

be shaken, and plenty of air to be supplied. Some motor is generally thought indispensable for these purposes. Wegener's device does not need a motor. As is customary, he starts with a small preliminary fire. The draught turns a vane, to whose vertical shaft the sieve is fixed. The coal dust passes through the sieve and falls on a double cone, where the air current gets full play. Mr. H. Schneider, chief engineer to the Union for Steam Boiler Revision, of Berlin, reports very favorably on some tests which he has been conducting with Wegener's grates. The heat is fully utilized; there is no stoking, and hardly any smoke, so that the adoption of the dust fuel would also solve the smoke problem. The uniformly distributed heat seems to spare the boilers. Official tests about other such appliances have not been published. But the Schwartzkopf dust fuel grate is also well spoken of in the *Zeitschrift des Vereins Deutscher Ingenieure*. At Hildesheim, where the plant was inspected, a Pforpe centrifugal coal disintegrator has been put up as an adjunct. That the coal has to be ground to a fine powder is a disadvantage. But if we can dispense with stokers, and save coal in addition, a great deal would be gained.

FOR UNDERBILLING SHIPMENTS.—The president and vice president of the Indian Rice Milling Company have been indicted by the federal grand jury at Kansas City for violation of the interstate commerce law, by reporting false weight, on a complaint brought by the superintendent of the Western Weighing Association and Inspection Bureau. The Indian Rice Milling Company, of Kansas City, entered into an agreement with the Western Railway Weighing Association, on January 1, 1895, whereby the latter was to allow all carload shipments made by the Indian Rice Milling Company over roads members of that association, to be transported under cover of a special agreement stamp, which was to be placed on the way-bills of the road carrying the property. This would secure the transportation of the car without being weighed in transit. The object of this agreement was to prevent errors in weights and overcharges that might accrue by reason of weighing cars on track scales. On the part of the Indian Rice Milling Company it was agreed that it would open its books to the officials or agents of the Western Railway Weighing Association as a check for the actual contents of cars, in order to verify the weights that had been furnished by the shippers on their bills of lading. About six months after the above agreement had been entered into it was discovered, so it is alleged, that the Indian Rice Milling Company was underbilling its shipments. Great difficulty was experienced by the railroad people in discovering the modus operandi pursued by the shippers in swindling the railroads out of a portion of their freight charges. Several times the books of the milling company were checked and compared with the records and weights furnished to the railroads, and no discrepancy could be found. Finally, Superintendent Carman had some of the cars shipped by the firm weighed and checked in transit, and, it is charged, demonstrated the fact conclusively that there had been underbilling. On a demand for rechecking of the books on the showing of the evidence procured by Mr. Carman the discovery was made that President Homer A. Judd had made a fictitious invoice book for the avowed purpose of deceiving and defrauding the railroad companies. Collections for undercharges were made on a large number of cars, amounting from \$18 to \$25 per car. Both the indicted parties have been arrested, one at Fort Worth and the other at Kansas City, and at last accounts were looking for bondsmen. The penalty for the offense, if convicted, is a fine of not more than \$5,000 and imprisonment of not more than two years in the penitentiary, at the discretion of the court.

SEATING HYDRAULIC VALVES.—The grinding in and seating of hydraulic valves is not a difficult operation, no more so, in fact, than for steam or water at low pressures, but it frequently does happen that when the pressure is first applied the valve will leak badly, even though there may be from 1,000 to 1,500 lbs. per square inch upon its back. We all know the value of a jar in starting a screw that is stuck, and even in persuading a valve that refuses to rise, to leave its seat. The remedy is, however, homeopathic, and when a newly ground valve in hydraulic work refuses to seat and persists in leaking, if the handle of the pressure pump is struck a smart blow with a light hammer and trouble will disappear and the valve come down to its seat at once; provided, of course, that the grinding has been well done.—[Dixie.]

NEEDS OF TECHNICAL SCHOOLS.—Speaking recently of the needs of a great technical college, and incidentally of the fact that very few laymen have a knowledge or even a conception of the magnitude of the work of educating a nation, Dr. Robert H. Thurston said that there are in the United States, for example, about 40,000,000 of children requiring instruction, 20,000,000 who have, or who will ask secondary education, and at least 100,000 young men and women capable of and rightly demanding the opportunity of securing higher education. When we are told that the United States government has given to the cause of education 150,000,000 acres of public lands, and that Cornell University alone has sold over \$5,000,000 worth of her endowment, and has still 5,000 good farms left for sale, the states sometimes expend as much as \$25 per capita of their population, and cities as much as \$35 on their public schools, we get a better idea of the extent to which a people make sacrifices of wealth for the benefit of the rising generation. Above \$100,000,000 are spent annually by the American commonwealth on education, maintaining 200,000 schools and their 300,000 teachers, two thirds of whom, by the way, are women. Even greater sums, proportionately, are spent in some instances by European

states. Prussia spent \$4,000,000 on its great technical school at Charlottenburg. Zurich has spent about \$500,000 on its great chemical and physical laboratories at its "Polytechnicum." Saxony pays out nearly \$500,000 annually on its university. The endowments of Harvard University are between \$6,000,000 and \$8,000,000; those of John Hopkins are \$4,000,000 or \$5,000,000, and those of Cornell and Columbia fall between these enormous figures.

NOT SO BAD AS COMMONLY REPORTED.—The Railway World relates an interesting incident in connection with the shooting of two Princeton students which has just become known. When the wounded men were examined it was decided that nothing could save the life of one of them except an immediate operation. A telegram was sent to Dr. Bull in New York City. He received the message after midnight, and at once went to the Pennsylvania Railroad station in Jersey City. The last train having gone, he asked for a special engine and car. He was informed that he would be obliged to pay a deposit of \$200 and also promise to meet any further bill that the company might present. Dr. Bull assented to this proposition, and the train was made up. He waited for some time for a bill from the company, and finally wrote asking that one should be sent to him. Instead of receiving a bill he received a check for the \$200 he had paid and a note saying that the company would make no charges for the special train, as the service was "in the interest of suffering humanity."

WIRE GLASS.—Mr. Francis Schumann, discussing wire glass before the Philadelphia Engineers' Club, stated that this material consists essentially of inserting woven wire, of larger or smaller mesh, as may be desired, in the middle of sheets of glass, when in process of manufacture. The woven wire, or "wire cloth," so inserted, binds the glass and thus prevents the sheet from separating when broken, and consequently removes the danger from broken pieces to people underneath. The older method of lessening this danger, when ordinary glass is used in roofs or floors, is to stretch wire cloth immediately underneath the glass; this is expensive and seriously interferes with the cleaning of the glass. In its manufacture there were difficulties at first in annealing, but they have now been overcome. Perfect annealing, by the way, is of vital importance in glass, and especially so in wire glass. Wire glass is now made most successfully, both in England and Belgium, under the Philadelphia patents, the manufacturers there readily overcoming the difficulties of annealing. By reason of imperfect annealing, in some of the glass made in this country and placed in buildings cracks soon appeared and justly caused complaint. Notwithstanding the cracks it is a remarkable fact, noted by those using it, that the glass does not leak, although used but slightly inclined to the horizon. The well known resistance of glass to heat and its non-conducting properties will make wire glass an important factor for window openings in buildings exposed to fire from adjacent structures. It is not safe to bed heavy glass directly on iron. There should be some soft or yielding medium, such as wood, rubber or rope, laid upon the iron frame for the glass to rest upon. A prolific cause of fracture is when the outer edges of the glass bear upon the iron, or where there is a lack of clearance between the edges of the glass and the standing ribs of the surrounding frame. Fracture is induced by any hard substance, such as iron, tending to abrade the corners of the edges, where the glass is most vulnerable, the action causing abrasion being from expansion and contraction between the glass and the supporting frames. When glass is laid directly upon the iron, care should be taken to insure ample clearance at the edges and that the bearing is within, alongside of the edge, aiming to free the edge from contact with the iron. That fracture in the wire glass is not due to any variations of expansion or contraction of the glass and wire is evident from the following: The usual size of sheets is about 36 in. wide by 72 in. long and ¼ in. thick. The most closely woven wire cloth used is of No. 28 wire, with meshes ½ in. square, making, say, 72 wires running longitudinally with the sheet. The No. 28 wire is 0.014 in. diameter, equal to 0.00019 square inch area, having an ultimate strength of 180,000 lbs. per square inch. The total ultimate resistance of the wires to tearing would be: 0.00019 × 72 × 180,000 = 2,462 lbs. The sectional area of the glass that resists this pull of 2,462 lbs. were the variations such as to cause fracture, is 36 × ¼ = 9 square inches. Assuming the resistance of the glass to crushing to be 6,000 lbs., its lowest value, the total resistance would be 9 × 6,000 = 54,000 lbs., or nearly 22 times greater than the strength of the wire. As the wire, in the process of being inserted in the hot glass, immediately acquires the same temperature as the surrounding glass, because of its rapid conductivity, it increases in volume, expanding the glass, yet semi-fluid, accordingly; then, when cooling, the wire, due to its greater contraction, shrinks away from the glass, leaving an annular clear space between the wire and the glass. Hence the wire cannot have any effect upon the glass by reason of any variation in expansion or contraction.

PATENT-OFFICE STATISTICS.—The report of Commissioner of Patents for the year ending Dec. 31, 1895, submitted to congress shows that during the year there were issued 21,998 patents and designs, exclusive of fifty-nine reissues and inclusive of 2,049 issued to foreigners; 1,829 trademarks and three prints registered and 46,899 applications filed for patents, trademarks, labels, prints, etc. There were also 12,345 patents which expired and 3,428 patents forfeited for non-payment of final fees. The four foreign countries leading in the number of patents issued to their citizens by this government are: England, 614; Germany, 539; Canada, 302, and France, 202. In the United States the states

leading in number of patents issued to their citizens are: New York, 3,539; Pennsylvania, 2,270; Illinois, 1,876; Massachusetts, 1,793, and Ohio, 1,423. In proportion to population, however, Connecticut heads the list with one to every 927 people. Reports have been received from thirty-two foreign countries, including Great Britain, Germany, Russia and France, and the total number of patents issued by these governments from the earliest period up to Dec. 31, last, aggregate 981,961, against 562,458 so far issued by the United States. During the last twenty-five years twenty-five inventors have been granted more than one hundred patents each, the whole number granted to them within that period being 4,894. In these, "Wizard" Thomas A. Edison, of Orange, N. J., leads with 711, Elihu Thomson, the electrician, coming next. The greatest activity of the year was shown in detail inventions and accessories to bicycles and in machines and processes for making the parts. Pneumatic tires have attracted the inventor, because of their now almost universal use on sulkeys as well as bicycles.

MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The meeting of the American Society of Mechanical Engineers opened in the parlors of the Southern hotel, St. Louis, on the evening of May 19, with President John Fritz in the chair. An address of welcome was delivered by Col. E. D. Meier, of St. Louis, which was responded to by President Fritz in an informal manner. After the addresses an informal reception was held, supplemented by a collation.

The session of the second day opened with the presentation of reports of committees and of the tellers of the election of members. Mr. Wm. T. Magruder presented an invitation to the society from various organizations of Nashville, Tenn., to hold the meeting of next spring in that city in connection with the celebration of the centennial of that state, which is to be celebrated by the Tennessee Centennial Exposition, which is to open May 1 of next year. The invitation was referred to the council for consideration.

The first professional paper which was read and discussed was entitled "Strength of Cast Iron" by Mr. W. J. Keep, of Detroit, and while the author is a member of the committee on methods of testing, this paper was presented without the responsibility of the committee. In reading abstracts of it, the author laid special stress upon the effect of silicon upon cast iron in changing white iron to gray and causing combined carbon to become graphitic, this being accompanied by softening, and a reduction of brittleness and an increase in the strength of small castings, but a decrease of strength of large ones by an increase in the size of the grain. Charts were given from which a founder may ascertain the amount of shrinkage which may be expected in a casting after the shrinkage of a test bar is known, and from this the necessary amount of silicon which a casting should contain in order to get the desired amount of shrinkage may be ascertained. Other charts show a near approximation to the strength of castings of different sizes containing different proportions of silicon.

The discussion was by Prof. C. H. Benjamin, Mr. Wm. Kent and Mr. Gus Henning. The latter gentleman showed that in taking autographic records of tests, especially upon cast iron, that the motion of the machine should be multiplied upon the diagram because of the fact that the variations are so slight as to be obscured by the width of the line of the pencil in ordinary apparatus. The device in use by the Messrs. Olsen was recommended, which multiplied the motion five hundred times. This speaker did not believe that it was possible to obtain the modulus of electricity of such a conglomerate cemented mixture as is cast iron.

Mr. Kent's paper entitled "The Efficiency of a Steam Boiler, What is it?" was read by the author and brought out a lively and interesting discussion. The main argument of the paper was to show that the term efficiency as applied to a steam boiler was misleading and tended to an increase in the trouble existing among the makers and buyers of boilers. It was shown that calorimeter experiments could not be relied upon to furnish accurate data as to the heating values of coals and there was also great difficulty in getting analyses of coal to check closely. The author strongly advised the use of the units of combustible and water per pound of coal instead of efficiency as a commercial standard. The efficiency varied from 73.82 to 85.83, according to carefully conducted investigation by different men, and units which involved such variations were not to be relied upon. If efficiency must be used in comparisons, the author urged that the specifications should plainly state the kind of coal to be used, the percentage of efficiency required, the manner of determining the

efficiency, and if by analysis by what chemist, and if by calorimeter, by whose instrument.

The discussion was opened by Mr. E. D. Meier, of St. Louis, who called attention to the objection to the use of the unit in terms of combustible owing to the influence of the manner of firing upon the amount of ash produced. He would base comparisons upon coal as there was a premium upon dropping coal through the grates when the results were stated in terms of pounds of combustible. He agreed with Mr. Kent as to the advisability of specifying the form of coal calorimeter where one is used, and recommended comparing boilers upon the basis of the heat values of coals. The discussion was taken up by Messrs. W. H. Bryan, J. B. Potter and Prof. J. H. Kinealy, of St. Louis, and also by Mr. A. A. Carey, of New York; Mr. Barnett LeVan, of Philadelphia, and Mr. Geo. I. Rockwood, of Worcester, Mass. The men having experience with western coals laid much stress upon the firing and were much less favorable to the unit of combustible than were the eastern representatives. Mr. Bryan had found no difficulty in regard to moisture in coal because of his practice to dry all the coal used in a test in the air for twenty-four hours. He also believed that coal could be satisfactorily sampled for calorimetric tests. Mr. Rockwood thought that comparisons should be made only upon the basis of evaporation of water, for so much money which was the unit in which manufacturers were most interested. Mr. Carey recommended the selection of some particular type of calorimeter before comparisons of efficiency are made. He also emphasized the importance of intelligent firing and thought that the boiler and furnace efficiencies should be separated in making comparisons. Special emphasis was placed upon the necessity of adapting the furnace to the coal which was to be burned. Prof. Potter argued against considering the combustible owing to the effects of variations in firing and the losses due to characteristic moisture in the coal. He urged the use of more chemistry and calorimeter work rather than less and believed that heat values should be used in addition to references to evaporation per pound of coal. Mr. LeVan recommended that the engineer should be consulted before establishing a specification for boiler performance. Mr. Kent, in closing the subject, stated that he had not changed his opinion in regard to efficiency and expressed the opinion that these comparisons had value among engineers but that they should be based upon some specified calorimeter, among which Bertholet's, Mahler's and Haempel's were mentioned as being most satisfactory.

The next paper presented was by Mr. A. H. Eldredge, entitled "Test of a Four-Cylinder Triple-Expansion Engine and Boiler." Its discussion was brief, and it was pointed out that the test was not of special value owing to estimations as well as to the fact that the performance of the engine was poor. The paper was not accompanied by any opinion or conclusions by the writer.

A paper by Mr. R. S. Hale, entitled "Determining Moisture in Coal," followed, which recorded work done in connection with the Steam Users' Association of Boston, and it was shown that all known methods were liable to error, the chief of which was due to the chemical changes in coal which followed the application of heat in drying out the moisture. Mr. Bryan opened the discussion by stating that he dried the coal used for a test for twenty-four hours in the air before beginning the trial, which was done to avoid errors in sampling. Mr. Kent showed that often coal was used which was too wet for such treatment, and recommended drying it in a steam-jacketed sheet iron barrel from which the moisture was collected by a condenser. Mr. Gus Henning recommended forcing dry air through the coal for the reason that this method did not heat the coal, and also because this method was rapid and easy of operation. Mr. C. W. Nason described an arrangement similar to a still, in which the moisture could be driven out of the coal by heating, and collected by a worm in a barrel of cold water.

After this discussion the second session adjourned. The third session on Wednesday evening was devoted to the reading of the paper by Mr. H. F. J. Porter, entitled "Hollow Steel Forgings." The appointed time for this subject was at the final session of the meeting, but it was advanced to enable the author to illustrate the discussion by stereopticon. A large number of lantern slides were shown upon a screen, and the author presented an elaborate and exceedingly interesting story of the introduction of steel forgings in this country by the Bethlehem Iron Works, and showed the process of manufacture, the heavy machinery employed and the product of the works in the line of heavy forgings, among which there were many heavy cranks and propeller shafts, guns, special castings. Not the least interesting

part of the talk was that describing the manufacture and testing of Harveyized steel armor plate for the battle ships, including that recently furnished to the Russian government. In this session, which was devoted entirely to the manufacture of steel, Mr. John Fritz, president of the society, was given credit for the introduction of the compression of fluid steel and the introduction of hydraulic forging to hollow ingots. After Mr. Porter's paper Mr. Fritz gave a brief statement of his work in perfecting the single plate steel armor which took the place of the laminated armor which had been in use by the navy of the United States. This was the result of eight years of constant work, during which time Mr. Fritz had been absent from the works but two entire days, and these were spent in looking up an engine for furnishing the hydraulic pressure.

THE IMPROVED SYSTEM OF THE AMERICAN SIGNAL COMPANY.

The apparatus of the American Signal Company has been before the public for a sufficient length of time to permit of its being considered a well-known system for the purpose of protecting highway crossings with railroads at grade. The company has been manufacturing road crossing signals for some time, the earlier forms of which employed track instruments. The latest system, however, avoids the use of such instruments, by the employment of track circuits the arrangement of which is shown in Fig. 1. Four joints are shown insulated at A, B, C and D by

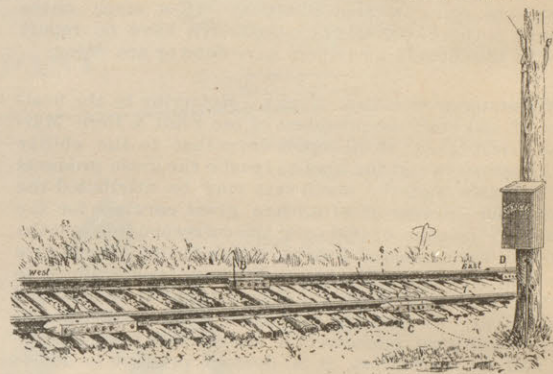


Fig. 1.—TRACK INSULATION.

the usual form of wooden track insulation. From the insulated sections, wires connected to the rails in the usual manner, are lead to the instrument box, which is placed upon the nearest convenient telegraph pole. The arrangement of the apparatus in the box is shown in Fig. 2, in which the wires are numbered and the parts of the apparatus are lettered for assistance in the explanation of the operation. This apparatus is the one employed for single track protection. The upper half of the box is partitioned from the lower and contains the controlling instru-

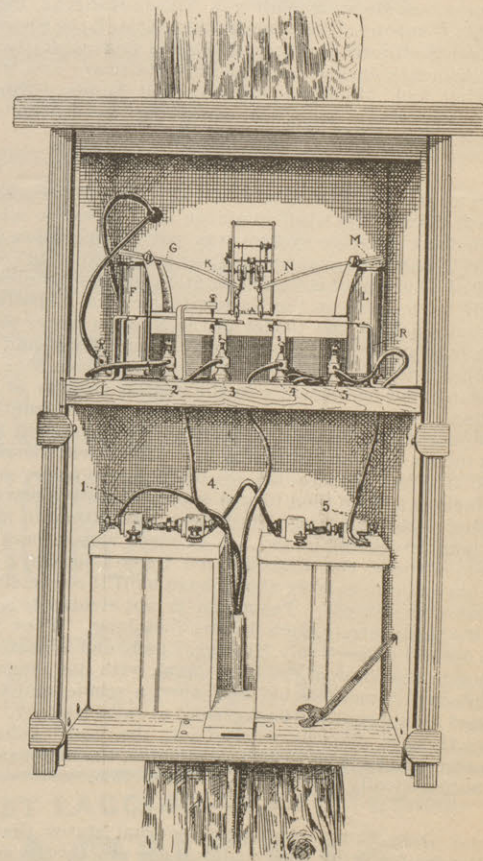


Fig. 2.—INSTRUMENT BOX.

ments while the lower part of the box holds the batteries.

Wire 1 is connected to rail 6, as shown in Fig. 1, and also connects with the battery which operates the controller. The wire 2 is attached to rail 7, and goes to the binding post 4, and the wire 3 connects the rail 8, to the binding post 3. The controller is connected to the battery direct by wire 5 of Fig. 2, through the binding post 5. Binding posts 1 and 2 connect the controller to the bell apparatus, making a complete metallic circuit from the track, through the controller and the bell apparatus to the track again. A train passing from east to west, Fig. 1, closes the circuit between rails 6 and 7, energizing the magnet F of Fig. 2. This attracts armature G, and operates lever K, closing the circuit to the bell and sounding the alarm. At the same time the magnet L and the rail 8 are cut out of circuit in which condition they will remain until the last wheels pass off of rail 7, when the armature G will be released. The circuit is broken and the lever K will automatically return to its normal position. The time required for this last operation is 15 seconds. The controller which is adjusted to allow ample time for trains to pass entirely off of rail 8 will automatically reset itself for action.

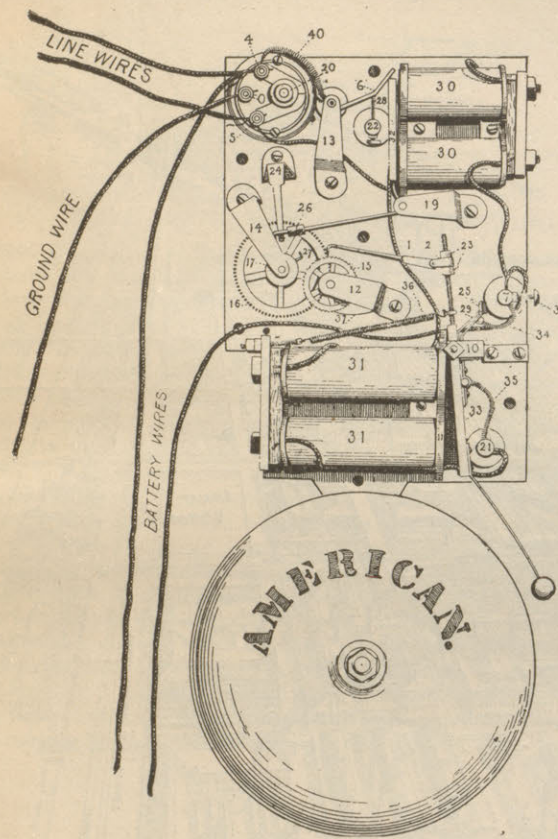


FIG. 3—THE BELL APPARATUS.

When a train is leaving the crossing on single track going from west to east, the circuit, Fig. 1, is closed between the rails 6 and 8 through the wheels and axles, energizing magnet L, and attracting armature M, which operates the lever N which raises the spring that normally bears on contact S and cuts the magnet F out of circuit. This will prevent any action of the lever K and also prevent the closing of the circuit to the bell apparatus on the crossing. The controller will be reset for action in 15 seconds after the last wheels of an east-bound train have passed off the rail 8. The arrangement for double-track is similar in principle to that shown for the single track, the mechanism becoming of course simpler on account of the absence of the necessity of providing for trains going in both directions over the crossings.

The bell apparatus is illustrated in Fig. 3, together with the connecting wires, its operation being as follows: When the circuit is closed by the controller at the crossing, the armature 32 of the bell apparatus is drawn to the right, the detent 26 is raised out of the notch in the drum 17, and is held suspended by the spring 24 until it is released by the trip pin 27, when it again falls upon the drum 17. When the armature 32 is attracted to the magnet 30, the hinged contact plate 6 which rests upon it, falls against the contact point 28, causing the current from the battery to be cut into the magnet 31 which operates the bell and also the ratchet pawl 1. As long as the detent hook 26 rests on the drum 17 the armature 32 cannot fall back far enough to break the contact between 6 and 28, consequently the bell must ring until the detent wheel 16 has made an entire revolution, when the hook will fall into the notch the circuit will be broken and the bell will stop. In the case of double-track application, if it should happen that a train reaches the circuit controller on one track, when a

second train has nearly reached the crossing on another track, the detent wheel will make another revolution causing the bell to ring twice as long as it would had there been but one train involved. The main battery for operating the bell is contained in a box at the level of the ground at the foot of the post upon which the bell is supported, the bell being encased in a box with windows of wire netting.

The battery employed consists of eight jars of one gallon each in capacity and employs oxide of copper and potash. It is reported to require refilling about once a year when the number trains operating the signal does not amount to more than forty per day. The battery does not require protection from frost as it is said to withstand a temperature of 40 deg. below zero, and is therefore not affected by climatic changes. It is also stated that the battery will not polarize, but will work with a constant output until completely exhausted. The surface of the liquid of the battery is covered with a layer of oil which protects it from evaporation.

The company has opened an office at 533 The Rookery, Chicago, of which Mr. John McKinnon is in charge as western representative. Mr. George W. Smith is president and general manager of the company, the general office being at 100 West Fayette street, Baltimore, Md. The company has all of the necessary apparatus for the protection of side and other secondary tracks, but for the protection of main lines the improved apparatus herein illustrated is employed. The special claims made for the apparatus are simplicity of construction and reliability. The batteries are not required to be placed underground. The company has recently issued a catalog setting forth the merits of the system which contains a number of references to railway officers who are using the devices.

RAILROAD ETHICS.*

H. D. JUDSON.

The system of discipline which obtains on the railroads of this country to-day is the one relic remaining of the practice of a generation ago. We have advanced in all other respects. In the construction of railroads the needs of the public have been met and discounted for years to come. In all other matters affecting transportation, railroads have kept abreast of the times and in harmony with the progressive spirit of the age, but in the management of men they seem unable to advance beyond the point from which they started when railroading was in its infancy.

Some of the foremost schools and colleges of the country have adopted what is known as a self government system of discipline; a system which appeals to the intelligence and sense of honor of the pupil. Our transportation lines in whose employ are hundreds of thousands of "children of a larger growth" still cling to a system which savors too much of the master and man idea, and, in the opinion of some, has nothing to recommend it but its age.

We have made more progress in our methods of dealing with things than with men. We have improved our tracks till we have a road bed and rail section capable of sustaining the heaviest and fastest traffic; we equip our lines with the latest improved and most powerful locomotives; we furnish the public with the most luxurious of coaches for their personal use, and with cars adapted to all classes and kinds of freight; we transport passengers and freight at a cost below that of any other country and at a speed of which the earlier builders of railroads never dreamed. But what are we doing for the improvement of the employe on whom the integrity of our service depends?

We spend considerable sums for laboratories in which to test the materials which are to be used in construction and repairs; we know the history of every bit of wood; the wearing qualities of our paints and oils; the tensile strength of each piece of iron or steel; we keep careful watch of the working of every new device, noting its performance with the utmost anxiety; but what do we know of the men we employ? How do we satisfy ourselves of their fitness for the work, and, once in the service and charged with responsibility, what do we know of their habits and their tendencies? Employes are too often selected in a haphazard way by the head of a department who has need of his services at once with no reference to a higher purpose than present needs.

More thought should be given to the capacity of the man to fulfil higher duties when called. However good a fireman you may think a man will make, if you are satisfied he has not the capacity to become a competent engineer, don't employ him. A man may be strong and nimble enough to do duty as a brakeman, but if he has not the making of a good conductor in him, don't engage him.

Being once in your employ, see that opportunity is given him to fit himself for advancement. What is our practice? Do we keep in touch with our men? Do we counsel and advise? Do we aid and encourage? Do we acknowledge and approve everything meritorious or do we simply discipline them for their shortcomings and leave them to be taken care of by other and different influences? And speaking of discipline, how is it administered? Do we inquire carefully into each offense? Do we consider the record of the offender, giving him credit for the good service he has performed? Do we intelligently weigh the effect

* Abstract of a paper read before the Western Railway Club April, 1896.

of the discipline on the service and on the individual, or is the discipline prescribed by a subordinate who is sometimes arbitrary and tyrannical and who, rejoicing in his power, uses it to wound and humiliate?

Do we not, all of us, know of good and true men who have been well nigh ruined by unnecessarily harsh treatment at the hands of some bumptious official? Do we not know of others who were going wrong in a way that would lead to their dismissal and perhaps their ruin, who have been reclaimed and set aright by the kindly, considerate interest shown them by a superior?

What is the object of discipline? Clearly to improve the service. The only way to improve the service is to improve the men. Are they being made better by the system which obtains? Obviously we have a higher grade of men than we had twenty years ago, but is the improvement not rather in spite of our discipline than by reason of it? The man who early learns that harshness is less powerful than kindness in commanding the services of another will have best success with his men. Chastisement is too often regarded as proper discipline. Too many men in charge of others seem of the opinion that the only way a man can be taught is to be made to suffer. "Touch his pocketbook," says one, "and he will not repeat the offense." Rather, it seems to me, should discipline be educative. And if this is true, is not our system wrong? Not that our discipline is too strict or too lax. It is both. But the system, it seems to me, is defective.

A man or a boy enters the shops of a great railroad and becomes at once a part of a great machine. Nobody notes his coming or his going. Nobody notes that his work is good, that he is sober and industrious, though quiet and retiring. Some day he ventures to suggest to his foreman an idea which he thinks is good. He is told to attend to his work and not concern himself with something beyond his province. Naturally diffident, he is easily crowded into a corner, where he remains. He becomes indifferent and mechanical, takes no thought to surrounding conditions, but plods on because he must, working for the whistle and the pay car.

He might have been encouraged to make suggestions and have become a more valuable man, but his foreman, from ignorance, jealousy it may be, or a desire to show his authority, or possibly, simply from a lack of knowledge of human nature, holds him down. Of course, there are "Some men like some trees who agree with any soil, who grow and thrive in spite of blight or neglect and under all treatments," but unless he have unusual pluck and courage and the skin of a pachyderm he will lose heart and receive a serious set-back.

He grows old in the service. He becomes unable to perform as much as he once did. He is discharged to make room for a younger man. What with buying a home and raising a family he has been able to save but little. He is now old, without work and without means. What an inducement for good men to engage in railroad work.

Perhaps he goes into train or engine service and in course of time comes to take charge of a locomotive or a train. He runs for years without trouble or expense to the company, when one day he is involved in an accident which costs considerable money. He is called before the superintendent or master mechanic, or both. The master mechanic is very busy and anxious to get back to his shops. The superintendent's liver is working badly. They are both irascible and the man is summarily disposed of by being sentenced to thirty days—not hard labor, better in many cases, if it were—but thirty days enforced idleness. For with all our progression we have not progressed beyond the old-fashioned way of punishing for accidents. Thirty days in which to go and come at will, degraded before his family and his fellows. Thirty days for the street, perhaps the saloon and the gaming table. The thirty days has cost him one hundred dollars, more or less, though profiting the company nothing, and he returns to work with a feeling that he has been unjustly treated and nursing his wrath against the day when trouble comes to the hated corporation. Nothing can be worse for company or for men than unrestrained power in the hands of a passionate or narrow-minded man. One subordinate with a quick temper and a sharp tongue, who thinks more of showing his authority than of keeping good men satisfied, can sow more discord in a minute than the most diplomatic manager can eradicate in a year.

I venture nothing in saying that half the strikes which railroads have suffered might have been averted by more considerate and intelligent treatment of employes by those in immediate control over them. I go farther and say that, in my opinion, if heads of departments were more broadminded and level-headed, used more moderation, appealed more to reason and less to force, the older and more conservative labor organizations would exhibit a more tolerant spirit, and the younger and more pernicious ones would die of atrophy.

It may be, in the case cited above, that a fair and impartial investigation was held and the man given every opportunity to present his side of the case. It may be that the official was tactful and courteous in his treatment. In that case there need be no sting with the sentence. It may be he had notions of his own about suspending the man, but something had to be done, and all the wisdom of railroad managers has, as yet, devised no scheme, at least has put into general practice no scheme more rational than depriving a man of his wage and subjecting him to enforced idleness.

A few of the smaller lines and at least one large system in the east, one important western line and certain divisions of others have put into effect a system of disciplining men which does away entirely with suspensions. There are other features, each one of which is an innovation, but the abolition of suspensions is what distinguishes the plan. On one road where the system has been in effect since June, 1894, the testimony of both officials and employes is to the effect that it works exceedingly well.

systems of sewers were of sufficient depth to meet the new conditions and entirely new sewers were required. One of the main systems begins at Thirteenth and Buttonwood streets, passes south on Thirteenth to Callowhill, thence on Callowhill to Twenty-third, and thence over Powelton avenue, Twenty-fourth and Wood streets to the Schuylkill river. This system acts as an interceptor for the sewers on the cross streets, draining the roadbed of the depressed subway and tunnel and the territory to the north. The second principal system intercepts the present sewer on Thirtieth street at Pennsylvania avenue, extends on Pennsylvania avenue to Twenty-fourth street, crosses under the proposed tunnel on the line of Twenty-fourth street, and empties into the Schuylkill on the line of Powelton avenue.

The entire sewerage system which was divided

street and Fifteenth street are to be carried over this depressed yard on bridges and by slightly raising the grades of the streets. The connection to the Baldwin Locomotive Works and to the present level of the warehouse at Sixteenth street is to be made by means of inclines with 5 per cent grades operated by ordinary locomotives.

Connection to the works of Messrs. William Sellers & Co., and A. Whitney & Sons is to be made by means of an hydraulic lift placed on the south side of Pennsylvania avenue, east of Seventeenth street. This lift is to be capable of raising a locomotive and three loaded cars at the same time from the level of the depressed tracks to the present level. A bridge over the subway will connect the north with the south side between Sixteenth and Seventeenth streets. The Baldwin Locomotive Works, between Seventeenth and Eighteenth streets; the elevator of the

involving, as they do, a very large number of problems of all kinds of construction. Among the most difficult of these may be mentioned the work of underpinning and supporting the many large buildings, warehouses and elevators, while the excavation is carried on and the masonry retaining walls built practically beneath their foundations. Again the operation of blasting the rock immediately adjacent to large buildings will require the utmost care in order to avert damage. Special machinery or methods for doing this excavation will be required.

All the present water and gas pipes and electrical conduits must be cared for and maintained during the operation, and either carried on the bridges or depressed beneath the subway, and railroads connections must be kept up with the various industrial establishments, and with temporary freight yards of the railroad company. The design of the large hydraulic lift and the ventilation of the tunnel, are also worthy of special mention.

The following information regarding the ventilation of the tunnel may be of interest. The approved general plans for this work contemplate a complete system of artificial ventilation by means of two fan stations placed on the north side of the tunnel. The fan stations will divide the tunnel into four almost equal sections, the stations being located about the middle of each section. In each station there will be two fans of about 20 ft. diameter drawing the foul air and gases from the tunnel through openings at intervals of about 150 ft. leading from the roof of the tunnel to the conduits which are located on the north side of the tunnel and parallel to it. The grade of each line of conduits is so arranged that any condensation will run to the fan stations where it will be properly provided for. The conduits are 11 ft. in diameter at the fan stations and decrease to 6 ft. 6 in. at the ends.

The fans will be driven by electric motors and will discharge into stacks high enough to prevent any inconvenience to the surrounding properties; and the conduits at the stations will be arranged so that the fans can be connected to either line of conduits, or one fan can exhaust from both in case of a breakdown or repairs being made. Each fan will have a capacity of about 150,000 cu. ft. per minute, and the entire plant will thus have a combined capacity of 600,000 cu. ft. per minute, or about one-fifth the entire cubic contents of the tunnel. It is thus expected that the entire contents of the tunnel will be replaced every five minutes. On the side of the tunnel fresh air intakes will be provided each with an area of 35 sq. ft. They will be connected on the level of the rail in the tunnel, and the openings into the street will be located in grass plats between the curb and the sidewalk. They will be placed midway between the exhaust openings. The power required to operate the electric motors will be obtained from

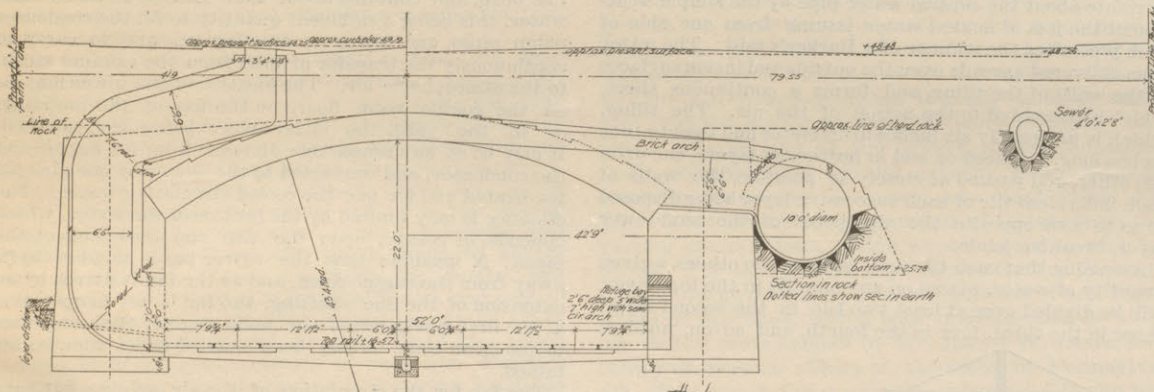


FIG. 2—SECTION OF TUNNEL SHOWING VENTILATING AND DRAINAGE SYSTEMS.

into six contracts has been completed. It embraces three and one-half miles of sewers generally from 20 to 40 ft. beneath the surface of the streets, and varying in size from 12 inch T. C. pipe 10 ft. 6 in. diameter. In order to cause the least inconvenience to travel it was specified that the work should, wherever possible, be constructed in tunnel, with shafts to the surface of the street at intervals. Fifty-two shafts were opened and about 65 per cent of the total work was constructed in tunnel. Driving tunnels and constructing sewers beneath the streets, in the heart of a great city; maintaining the flow in existing sewers and other municipal structures; requiring blasting in the closest proximity to industrial establishments containing delicate machinery; meeting treacherous quicksands through which the sewer must be constructed; fighting the tides where the construction extended through old wharves with the foundation below the level of low tide, required the greatest diligence on the part of engineers and contractors in order to accomplish the desired end. In

Philadelphia Grain Elevator Company at Twentieth street, and the Knickerbocker Ice Company's plant west of Twenty-first street are to be connected with the subway by means of inclines with 4 and 5 per cent grades, operated by ordinary locomotives. Connections to the works of Bement, Miles & Co. are to be made from the lower level. The triangular yard between Twentieth and Hamilton streets and Pennsylvania avenue, now occupied by the Philadelphia & Reading Railroad Company, is to be excavated to contain the new engine, freight house and repair shops and Twenty-first street carried over the yard upon a bridge. These parts of the work may be seen in Fig. 1.

Just east of Twenty-second street the tunnel is to begin. It consists of a single span, brick arch, 52 ft. span, 8 ft. 8 in. rise, designed to provide for four tracks, and will extend from the above named point approximately to the present entrance of the Baltimore & Ohio tunnel west of Twenty-sixth street, a distance of 2,910 ft. A cross-section which shows

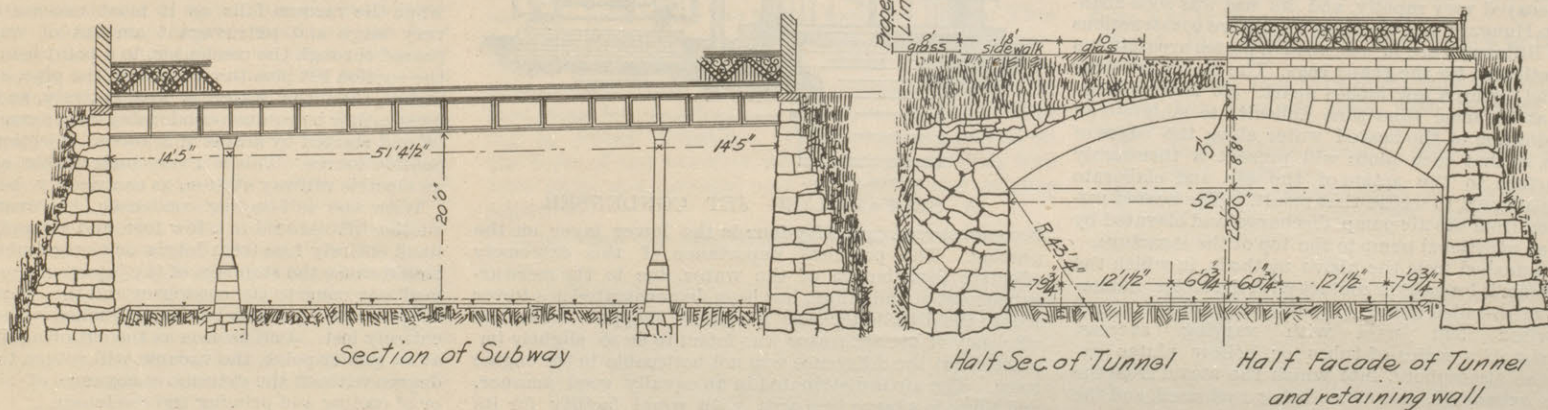


FIG. 3.—SECTIONS OF SUBWAY AND TUNNEL SHOWING PORTAL.

spite of these and many other difficulties these sewers have been finished in a satisfactory manner.

This preliminary work is completed and everything is in readiness to begin upon the main work of construction. At the time the plans for the sewers were prepared the work of preparing the detail plans for the construction of the subway and tunnel, and making the connections to the various industrial establishments along the line of Pennsylvania avenue was begun and pushed rapidly. Separate studies were required of each connection in order to secure a satisfactory and economical arrangement. The plans as completed provide for a very slight change in the grade of Twelfth street, the railroad being carried over it as at present. At Thirteenth street the railroad tracks will cross at about the present level of the street, requiring the lowering of the street to pass under the tracks. Between Thirteenth street and a point near Sixteenth street, the entire space between the north side of Callowhill street and the north side of Pennsylvania avenue, is to be excavated, forming the depressed freight yards of the Philadelphia & Reading Railroad Company. Broad

also the ventilating arrangements is given in Fig. 2. A cross-section of the subway is shown in Fig. 3. Owing to the heavy traffic contemplated and to the very large dimensions of the tunnel a complete system of artificial ventilation, with side exhaust conduits, fresh air intakes and two fan stations, has been designed to provide the requisite supply of fresh air. It has been found necessary to widen Pennsylvania avenue from Twenty-second street to Fairmount avenue on account of the construction of the tunnel, and after the work is completed the avenue over the tunnel will be paved and provided with grass plats, making a magnificent boulevard and an appropriate entrance to Fairmount Park. West of the present entrance of the Baltimore & Ohio tunnel, the tracks will be carried in a gradually ascending open subway to the present level of the tracks at Thirtieth street. The present footway bridges over the tracks at Twenty-seventh, Twenty-eighth and Twenty-ninth streets will be reconstructed in their present positions.

The engineering difficulties in the construction of a work of such magnitude are many and various,

a power house to be located at about Nineteenth street. This power house will also supply the power for operating the hydraulic lift at Seventeenth street.

The department of public works has made careful and exhaustive studies of the best methods to be attained in carrying out this work, the results of which appear in the plans and specifications. The remaining work has been divided into 21 contracts for the purpose of letting and construction, and over 600 general and detail drawings have been prepared.

The ordinance of councils authorizing this work appropriates \$6,000,000 for its construction, of which amount the Philadelphia & Reading Railroad Co., is to pay one-half.

The officials in charge of this work are Mr. Thos. M. Thompson, director of the department of public works; Mr. George S. Webster, M. Am. Soc. C. E., chief engineer, bureau of surveys; Mr. Joseph M. Wilson, M. Am. Soc. C. E., consulting engineer, Philadelphia & Reading Railroad; Geo. E. Datesman, C. E., principal assistant engineer, bureau of surveys; Mr. Samuel Tobias Wagner, M. Am. Soc. C. E., first as-

sistant engineer in charge of the work; Mr. R. I. D. Ashbridge, C. E., second assistant engineer in charge of construction; Mr. Charles H. Swan, C. E., chief draftsman.

A SELF-COOLING CONDENSER.*

LOUIS R. ALBERGER.

It is the object of this paper to present to the attention of the society a practical condensing apparatus for use with steam engines, and one that, while operating without a natural water supply, gives results that compare most favorably with those obtained in the ordinary manner. Because the circulating water employed to produce the condensation of the steam is cooled by the apparatus for reuse in itself, it is called a self-cooling condenser. It depends, however, for its effectiveness upon the capacity of atmospheric air to carry off heat and moisture when brought into intimate contact with heated water.

Broadly considered, the air becomes the condensing medium in the place of cold water as ordinarily employed, and, on account of its general distribution, the process can be performed at any place that may be desired. The adoption of this machine gives to all users of steam power a means of economy heretofore commercially unavailable, except to those whose engines are in close proximity to an abundant natural water supply. Non-condensing engines, in any locality, can be run condensing, with all the benefits that accrue, by the use of a vacuum. In the installation of a new steam-power plant, the highest types and most modern practice of compound and triple expansion condensing engines can be used, without reference to the quantity of water available, except to provide a sufficient amount for boiler feeding purposes.

The idea of cooling the discharge water from the air pumps and reusing it in the condenser is an old one, and, in fact, steam plants are in operation in which the heated discharge water is delivered into a pond and allowed to cool to as low a temperature as possible before being used again. Open pans placed in the yard adjoining the engine house, or on the roof of a building, have been found fairly serviceable in a few instances where the structures were of sufficient expanse and were strong enough to support the weight. Both of these methods of cooling water are slow, and, as only the surface exposed to the air is active to any great extent, very large areas are required; and, furthermore, they are uncertain, as they rely upon the favorable conditions of the wind and atmosphere for anything like satisfactory results.

In Europe the heated water is sometimes pumped upon upon a pile of brush or fagots, and in that way caused to expose a large surface to the air. Modified and somewhat improved forms of this plan have been used for a long time on the island of Cuba, in connection with vacuum pans, in the manufacture of sugar, at places where water is scarce, the prevalence of trade winds adding much to the reliability and effectiveness of these contrivances.

Rilleaux, who is credited as being the inventor of multiple effect evaporating apparatus, many years ago suggested the use of gunny bags, suspended by one edge and arranged in a series, with a space for the circulation of the air and a device for supplying the heated water along the upper edge of the bags. He found, however, that the cloth, subjected to the combined action of heat, moisture, and air, decayed very rapidly, and its use was soon abandoned. In Hungary and Germany expensive constructions quite like Rilleaux's are in use, wooden plates or partitions being substituted for the gunny bags. The plates are hung in a parallel series a few inches apart. It is very desirable, and at the same time difficult, to maintain an even distribution of the heated water along the edges of the plates, so that each plate will present a thoroughly wetted surface to the action of the air, and elaborate means are adopted to secure that result. The heated water is taken from the air-pump discharge and elevated by means of an additional pump to the top of the structure.

As distinguished from the above methods, in which the exhaust steam is brought in contact with the water, numerous forms of so-called air or evaporative condensers have been devised and used with varying success. They consist of a series of tubes or hollow plates exposed to the atmosphere, into which the steam from the engines is exhausted, the steam being condensed, and the water resulting from the condensation, after being freed from the lubricating oil from the engine, is fed into the boiler. This system was experimented with for a long time on the London underground railroad, where its success would have been very desirable. The surface required to merely condense the steam without producing even a moderate degree of vacuum was very large, and the machine, to be full of effect, was bulky and expensive. The efficiency of this type of condenser can be increased by continually wetting the surface of the tubes exposed to the air. Aside from the cost, which prevents its commercial use, it possesses a very great practical disadvantage in that the whole structure, including the tubes, with their fastening devices arranged to accommodate expansion and contraction, requires to be air-tight against atmospheric pressure.

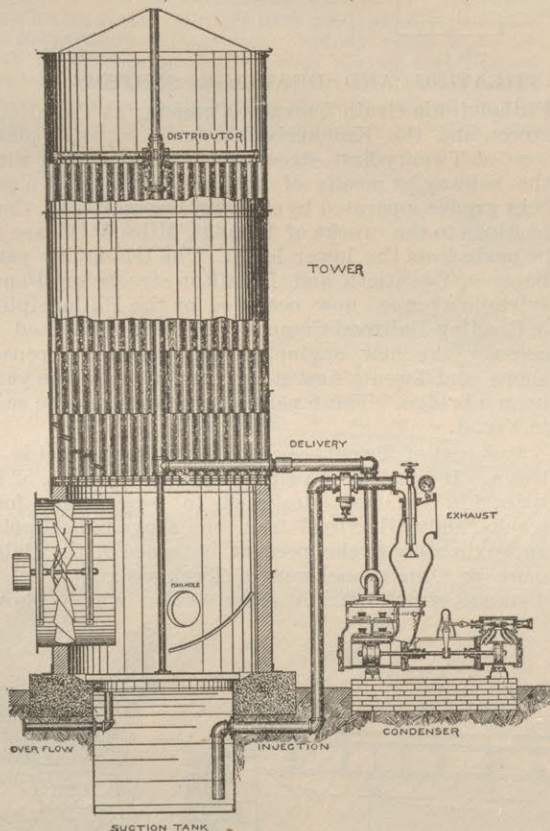
It is obvious that such methods and constructions, while interesting and in a limited way operative, would be inapplicable to the large majority of steam plants of considerable capacity with which we are familiar, and which have become so necessary for modern mill, electric light, and railway purposes during the last few years.

An apparatus for this purpose, and one that can be safely employed as a reliable portion of a steam-power plant,

*Abstract of a paper read before the American Society of Mechanical Engineers, May, 1896.

must be simple and compact in construction, thoroughly durable, and so completely under control as to be practically independent of changes of wind and weather. These features are to be found in the self-cooling condenser, as illustrated in section in the accompanying engraving. It consists of two parts—the condenser, in which the exhaust steam of the main engine or engines is condensed, and the tower, in which the heated discharge from the condenser is cooled to a proper temperature to be used again for the further condensation of exhaust steam. The tower consists of a cylindrical steel shell open at the top, supported upon a suitable foundation, and having fitted at one side a fan, the function of which is to circulate a current of air through the tower and its filling. This filling consists of layers of cylindrical tubular tiling, which rests upon a grating supported by a brick wall extending around the circumference of the tower. The heated discharge water from the condenser enters the tower at the side, passes up the central pipe, is delivered on the upper layer of tiling and over the whole cross section of the tower by a distributing device consisting of four pipes, which are caused to rotate about the central water pipe by the simple reaction of the jets of heated water issuing from one side of each pipe after the manner of a Barker's mill. The water thus delivered spreads over the outside and inside surfaces of the walls of the tiling, and forms a continuous sheet, which is presented to the action of the air. The tiling, which is preferably six inches in diameter and twenty-four inches long, is placed on end in horizontal layers, one upon the other, and packed as closely as possible, the walls of each individual tile of each successive layer being disposed so as to come opposite the air spaces of the next lower layer, breaking joints.

Assuming that each tile rests on only two others, a given quantity of water, placed on any one tile in the top layer, will be divided over at least two tile in the second layer, three in the third, four in the fourth, and so on, until it



A SELF-COOLING JET CONDENSER.

becomes spread over fifty-four in the lower layer on the grating. The practical importance of this extremely effective distribution of the water, due to the mere arrangement of the filling, has been demonstrated in a tower where the distributor was purposely stopped, when the efficiency of the apparatus was found to be so slightly impaired that the difference was not noticeable in the engine room. The air is distributed in an equally good manner, and there is a large free area with equal facility for its passage upward over the entire cross section of the tower. The heated water falling through the tower is cooled by three processes: first, radiation from the sides of the tower; second, the contact of cool air; and third, evaporation. This latter is by far the most important, as the evaporation of a pound of water in this way carries off about 1,000 units of heat, and enables a pound of steam to be condensed in the condenser. As quite a proportion of the cooling is done by the first two processes, the evaporation of water in the tower must be less than the water formed by steam condensed in the condenser. Consequently the supply of circulating water is constantly augmented and requires no replenishing. The cooled water falls from the grating to the subsiding tank at the bottom, and is from there drawn by the condenser to again perform condensation.

There is constantly coming into the system water from the city mains or other source to feed the boilers. There is constantly going out of the system the water evaporated in the tower, an amount that is less than that which comes from the steam condensed, and the slight overflow from the suction tank that will carry off the oil and grease that come from the engine with the exhaust steam, and which would tend to accumulate in the suction tank.

In situations where the water to be had for boiler feeding is so impure as to form objectionable scale in the boiler,

ers, a modification of the apparatus may be used to great advantage. This modification consists in the substitution of a surface condenser with air and circulating pumps for the jet condenser and pump.

The circulating pump draws the cool water from the suction tank, passes it through the tubes of the surface condenser and the tower and back again in a continuous circuit to the suction tank. The exhaust steam from the main engine brought in contact with the outside of the tubes is condensed. The pure water thus formed, together with the air and uncondensable vapor, is removed by the air pump and delivered to the hot well, from whence the water is fed to the boilers. The loss to the circulating water by evaporation in the tower must needs be made up from the source of water supply.

The floor space occupied by the cooling tower of this self-cooling condenser is not excessive, as will be appreciated when it is understood that an apparatus suitable for 1,000 horse power is only 17 ft. in diameter and 30 ft. high. The suction tank, which is placed directly under the tower and in the foundation, is 8 ft. in diameter and 7 ft. deep, and contains about 2,000 gallons of circulating water, this being a sufficient quantity to fill the condenser pump, pipes, and tower on starting up, and to carry on continuously the transfer of heat from the exhaust steam to the atmospheric air. The location of the tower may be on the engine room floor, on the top of the building, or in the yard, the latter place being well adapted. It may be at any reasonable distance from the engine and the condenser, and connected to the latter by one pipe for the heated and for one the cooled circulating water. The distance is only limited by the friction of the water, which depends, of course, upon the size and directness of the pipes. A machine that the writer has in mind is 150 ft. away from the engine room, and as the fan is driven by an extension of the line shafting, the fan is set in operation at the first movement of the main engine, the condenser in the mean time having been started and a vacuum obtained.

The fan for the circulation of the air requires but very little power for its operation, and careful tests have shown it to be less than 2 per cent of the power of the main engine during the maximum requirements of summer, while the average for the year in this climate will not exceed 1¼ per cent. The fan may be driven by an electric motor, belting from the main shafting, or by a small steam engine, as the conditions of the situation may render most desirable. The latter method is usually preferable, as the speed can be more easily regulated to suit the requirements.

It may be well to mention a feature of superiority of the self-cooling condenser over a condenser dependent upon a natural water supply such as is usually to be had, especially when used in connection with steam engines subject to great variations of load, as are found in electric railway, rolling mill and similar irregular work. It is substantially correct to say that not less than half the condensing apparatus in use in connection with stationary engines are located so as to be compelled to lift the injection water at least 16 feet, and a number as high as 20 to 22 feet. This is caused by the fact that the stations or mills, if they are alongside of a river, are usually placed upon moderately high and firm ground. The result of this arrangement is that, in case of a sudden overload of the engine by which steam may be carried three-fourths of the stroke instead of one-fourth of the stroke as normally, the condenser is not capable of maintaining the full degree of vacuum, and when the vacuum falls, as it must necessarily, unless a very large and extravagant amount of water is being passed through the condenser, to a point below that due to the suction lift plus the friction in the pipe, say to twenty inches, then the water is lost entirely, and the engine must either be run non-condensing or the condenser cooled off and started by means of a forced injection from some outside source. This is a very undesirable occurrence in an electric railway station, as can readily be understood.

With the self-cooling condenser, however, having the suction lift reduced to a few feet, and a supply of water on hand entirely free from debris or foreign material such as would cause the stoppage of the injection supply, an overload may come to the condenser and the vacuum temporarily fall to a point as low as ten inches without becoming entirely lost. Just as soon as the cut-off again takes place at an earlier point, the vacuum will return to the normal degree without the extreme annoyance of shutting down or of cooling and priming the condenser.

NATIONAL CONVENTION OF RAILROAD COMMISSIONERS.

The eighth annual national convention of railroad commissioners was called to order in the rooms of the Interstate Commerce Commission, in Washington, on May 19, by the Hon. H. R. Billings, of Michigan, chairman. In addition to the members of the Interstate Commerce Commission, all of whom were present, only fourteen states were represented at the meeting. After the call of the roll, the chairman addressed the convention as follows:

The Chairman—Gentlemen of the convention, to me it is an honor to be a member of this national convention of railroad commissioners, and upon assuming the duties of presiding officer, allow me to express my appreciation of the high honor which has been conferred upon me by being selected to preside over your deliberations.

Perhaps it would not be out of place for me to make a few remarks by way of suggestions, which will draw our attention to some of the purposes for which this convention is called.

We have met here, some of us many times before, to learn of each other; to build up and enlarge the usefulness of our position; to make the office of railroad commissioner in each of the several states a power for good; to discuss methods and means, and adopt such plans as will make the state supervision of railroads by the commissioners of the several states more uniform and efficient. It is desired that we get together that we may move forward with concerted action on well-established lines of public policy.

There is reason for this union of action, as railroad business is not confined to state lines. The same cars and coaches move on continuous lines through the several states, necessitating the cooperation in carrying out any general needed reform by government regulation.

The question of reasonable rates, uniform classifications of freight, safety methods of heating and lighting cars, automatic couplers, air brakes, and other safety appliances can not be so well perfected or made effectual by a state acting singly as by a concerted action of all the states. An exchange of thought by such representative men as make up this body can but result in good to the people and at the same time establish a standard of fairness to the railroad companies.

It is well for us, at this time, to keep in mind the present status of railroad interests. The great wave of building railroads for speculative and other purposes has gone by. The phantom that there were large returns for money invested in railroads has vanished, and they must now prove their actual value and reason for their existence.

There was a time when railroads were the petted wards of the people, the state, and even the nation. Every village, city, and state wanted railroads, and were ready to contribute, with lavish hands, to aid in their construction. Money was given, the country was bonded, and lands donated to build railroads; and add to this enthusiasm and substantial encouragement the American zeal for speculation, and we have the forces which brought forth this great network of railroads. But this condition of affairs has changed; the fostering hand has been withdrawn and the question that confronts us now is, can these railroads be made self-supporting? There is no question as to those that are favorably located; they can survive without a doubt and prove their necessity by fair returns. But with many of the weaker roads the problem is unsolved.

The energy and effort that was put forth to build up and foster is now largely directed in tearing down and destroying. Many politicians' stock in trade, the winning card in a game of votes, is an attack on railroads. The vote-getting office seeker proclaims to the people that railroad corporations are all powerful, and through this modern humbugging process seeks their support, knowing that corporations at the ballot box, as well as before court juries, are weak indeed. In safety he may say, "Elect me to office and I will give the railroads a twist." When we count the number of railroads in the hands of receivers to-day the momentous fact comes to us that reaction has set in and many railroads are getting a twist with vengeance.

We are confronted with an almost insolvable problem—to give justice to the railroads and at the same time be just to all the people. Cheap and rapid transit is revolutionizing the business world; it is building up and tearing down; destroying the business in one locality and building it up in another; making one rich, another poor. To one the transportation is too cheap, to the other it is too dear. In agriculture cheap transportation of farm products has nearly wiped out the New England farmer; has brought those of the middle states upon their knees and built those up farther west, while those of the extreme west clamor that rates are too high and that all profits are absorbed in transportation. Cheap passenger fares are destroying the business of country merchants and small villages and building up and concentrating business in large cities. The great cities want passenger fares still cheaper, and make them so by frequent and cheap excursions, thus enabling large department stores to absorb the trade for many miles around.

This business revolution can not be stopped, but every effort should be made to protect the weak against the strong. No two prices should be allowed. No wholesaling of transportation should be permitted. Every form of discrimination should be prohibited. All legislation and rulings of commissions should be in the line to promote safety, equality, and stability.

The committee on program presented the following report:

1. Paper of A. B. Stickney.
2. Paper by W. B. Clough.

Reports of committees appointed to report to this convention:

- I. Railway statistics.
 - II. Uniform classification.
 - III. Legislation.
 - IV. Protection of public interests during railway labor contests.
 - V. Regulation of state and interstate electric railways.
 - VI. Powers, duties, and actual work accomplished by the several state railroad commissions during the year.
 - VII. Government control and government regulation of railways.
 - VIII. Safety appliances.
 - IX. Pooling of freights and division of earnings.
- Additional topics:
- I. Demurrage and transportation delays.
 - II. Overcharges and undercharges.
 - III. Delays attendant upon enforcing orders of railroad commissions by procedure in the courts.

The paper of Mr. A. B. Stickney, president of the Chicago Great Western Railway, was next presented.

(This paper will be found on page 290.) A paper on the "Influence of the Interstate Commerce Law on Railway Traffic Earnings," by Mr. W. P. Clough, of the C. St. P. & Mo. Ry., was next read. Reference to this paper will be made in a succeeding issue.

The report of the committee on railway statistics was next submitted and ordered printed. The report of the committee on classification was passed until the following day.

Next followed the report of the committee on protection of public interests during railway labor contests in which the use of the army and of the injunction as a means for accomplishing this result, was deplored and the ground taken that inasmuch that prevention is better than cure, public interests will be best protected by avoiding strikes through mediation, conciliation and arbitration. The report of the committee on regulation of state and interstate electric railways was next presented, in which it was held that in view of the rapid growth of these enterprises there was much need of wholesome legislation and regulation, and that the matter should be committed to the railway commissioners of the various states, it being thought desirable that the laws governing the same should be uniform. The subject of the powers, duties and actual work accomplished by the several state railroad commissions during the year, was next taken up. The report consisted of a number of letters from the various commissions, which were listened to with interest. Following these reports was that of the committee on government ownership, control and regulation of railroads, which was supplemented by a paper on the same subject by Mr. James W. Latta, secretary of internal affairs of the state of Pennsylvania, after which the convention adjourned to the following morning. The subsequent proceedings will be noted next week.

TURRET LATHE AND SCREW MACHINE.

The accompanying illustrations are reproduced from photographs of a turret lathe and screw machine recently brought out by the Niles Tool Works Co., of Hamilton, Ohio, and specially adapted for railroad work. The weight of the machine is 5,000 pounds, and, as this would indicate, it is a stiff, rigid tool, which will handle heavy work with facility and dispatch. The spindle is large in diameter and hollow for allowing stock to pass through. The chuck will grasp any form of stock and the jaws are opened and closed by power throughout the entire range from one-half an inch to full opening which will admit stock 2 in. in diameter.

A gibbed carriage is provided having front and back tool posts and also carrying a die plate in a hinged arm. The dies are opened at the end of a cut so they can be quickly backed off. The carriage has a power feed through a screw located centrally in the bed which allows of cuts being taken by the carriage tools while the turret tools are in use. This feed screw also engages the turret so both the carriage and turret may be fed in either direction simultaneously. The turret has automatic adjustable feed stops for each tool and will operate when feeding in either direction. These stops are placed on the front of the machine where they are entirely free from chips and dirt and may be readily and quickly adjusted.

Long work can pass through the turret without in-

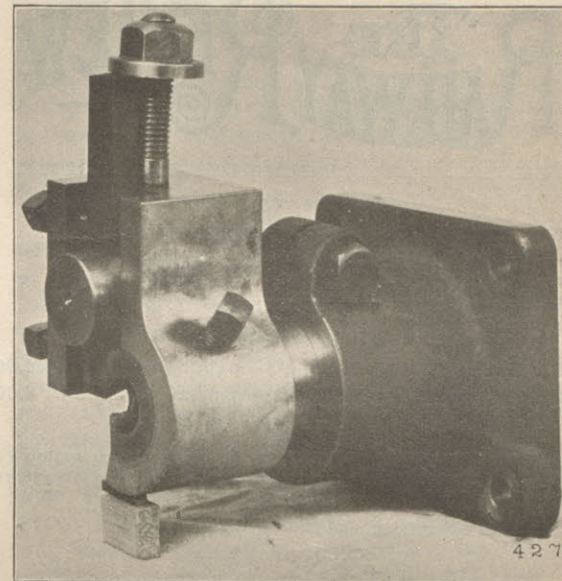


FIG. 2.—TOOL HOLDER.

terfering with the action of the tools. An oil pump and reservoir are provided with convenient pipes and all chips and dirt are separated from the oil before it reaches the pump. The illustration, Fig. 1, shows the general appearance of the machine, and Figs. 2 and 3 show two of the turret tool holders.

The machine includes the following equipment:
Automatic chuck, all sizes without change.
Automatic stop feeding device.
Carriage, with front and back tool post.

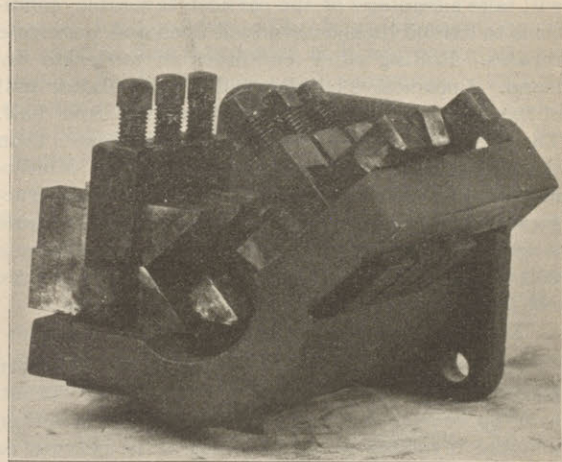


FIG. 3.—TOOL HOLDER.

Opening die plate and arm, with eight sizes of dies from $\frac{1}{2}$ to $1\frac{1}{2}$ in.

Solid die holder, with dies from $\frac{1}{2}$ to $1\frac{1}{2}$ in. (standard.)

One turning tool with eight bushes, from $\frac{1}{2}$ to $1\frac{1}{2}$ in.

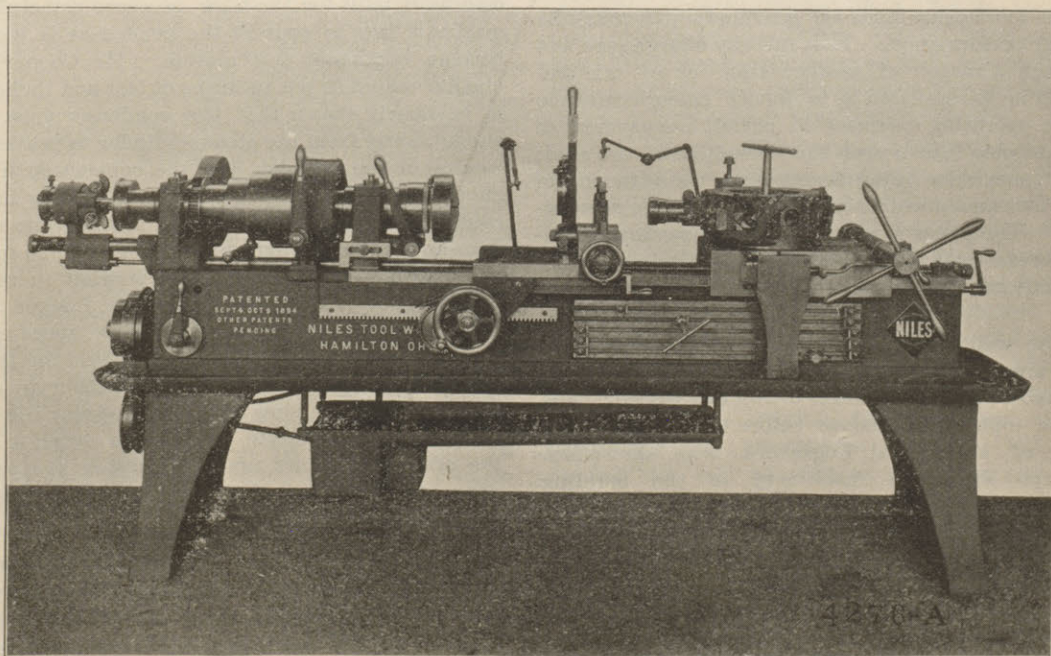
Two box turning tools, with turning posts and back rest.

Four tool holders, one drill and center holder.

One stock gage.

One oil pump, countershaft and wrenches.

A taper tool (turning) with former, can be furnished, if desired.



TURRET LATHE AND SCREW MACHINE—FIG. 1.—FRONT VIEW.

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CHICAGO, SATURDAY, MAY 23, 1896.

WESTERN railroads are purchasing small lots of steel rails with more freedom and rail makers say there is better inquiry but no signs as yet of anything like old time activity. Managers of many railway properties have explained to rail makers that they will take advantage of the earliest favorable conditions to extend lines determined upon and prosecute repairs. Rolling stock continues in moderate demand. Locomotive builders believe the latter half of the year will be much better than the first half. The average of steel prices is a trifle lower than thirty days ago. Pig iron is accumulating. Middlemen's billits still unsettle prices. Plate and structural mills are doing more work than in April, and it appears now that July and August requirements will be quite heavy. Consumptive requirements do not press hard in any direction.

THE president of the Chicago Great Western Railway is certainly nothing, if not radical. Whatever he considers to be a correct principle of action, whether it relates to the building of a railroad or the declaration of principles which should govern its operation, is adopted with but little regard for consequences. That Mr. Stickney is not afraid to tell the truth has been abundantly attested, and because his public utterances and commonly of that character, they are always interesting as well as readable. His latest declaration concerning railway matters is in the form of a paper presented to the convention of railroad commissioners held in Washington during the current week, and which is published in full in this issue. The burden of the paper is to the effect that government having authorized railroads to perform for it a delegated function, is obligated to see that sufficient funds are provided to guarantee its proper performance. That railway charges are not so much a matter of compensation as of tax and should be so regulated as to insure enough revenue above operating expenses to permit the payment of an equitable return upon the securities of the road; which securities being issued under the authority of the government are *prima facie* entitled to recognition. The paper is recommended as worthy a careful perusal even though either its premises or conclusions may not be generally accepted.

IT IS well known that the original mechanical laboratory at Purdue University was destroyed by fire and a valuable lesson is drawn by Professor Goss, in the topical discussions before the American Society of Mechanical Engineers, from the effects of the fire upon machinery in the building, which tended to show that the damage to machinery which was supported upon solid foundations, was very much less than to these machines which on account of not being placed upon good foundations were allowed to fall by the burning away of the supports. Three causes for damage were mentioned, namely: The falling of the machinery, the falling of the roof timbers and walls

upon the machinery, and the action of the heat itself. The damage to the machinery which was properly supported was comparatively slight. Castings with large flat surfaces, either plain or ribbed, were found in some cases to have suffered from fire cracks, but heavy castings of good design with very few exceptions did not suffer from the heat. In case of fire the light attachments to machines are of course liable to damage from the falling of timbers and other portions of the roof or of the floors above, and it is to be expected that bushings and babbitt will suffer to greater or less extent dependent upon the heat to which they are exposed, but the good condition of the well supported machines after the fire would seem to point to the advisability of putting in permanent foundations for expensive heavy machines.

THE convention of railroad commissioners held in Washington during the current week, was slimly attended, showing a declination of interest in the meeting by the commissioners of the various states. It is somewhat difficult to understand why this should be the case. The proceedings of the convention both in the matter of papers and discussion are generally speaking of a high order, and there can be no doubt but that those commissioners who have attended these meetings in years past have derived much benefit therefrom. At the time of going to press the final proceedings of the convention have not been received and no knowledge is had as to the meeting for next year. It may be possible, however, that the convention has adopted the suggestion made at previous sessions and selected some other place than Washington for its next meeting. Railroad commissioners are much like other men and need the incentive of new scenes in order to induce their attendance. The mechanical associations of the railroads have found the attendance at their regular meetings largely increased by reason of their varied selection of the place of meeting, and it is probable that if to the attraction of the convention itself could be added the sojourn of a few days at one of the many popular summer resorts each year, the convention which now seems doomed to die a lingering death might be revived and made both profitable and pleasurable.

A VALUABLE suggestion as to the location of a condenser of a steam engine with reference to the cylinder was given to the mechanical engineers in a topical discussion, by Mr. John H. Cooper, who pointed out the fact that the condenser of the New-comen engine was too close to the cylinder. This is rather a play upon words because the condenser of that engine is in the cylinder—the two are combined and consequently the economy of the engine is sacrificed. To go to the other extreme, he had found that an exhaust connection to the condenser which was fifty per cent longer than the engine bed showed almost no vacuum in the cylinder even when a very satisfactory vacuum was obtained in the condenser. In view of the fact that condensers are likely to be applied in future to a number of engines which were originally built for the high pressure principle, the matter of how to connect the condenser is likely to become important information. Mr. Cooper's conclusion cannot be put in terms of feet and inches, but it is clearly shown that the condenser must be far enough away from the steam cylinder to prevent the cooling of the cylinder and the connection must be short enough to admit of the steam getting into the condenser without its standing in the pipe uncondensed. It is recommended as a good plan to gage the length of the connection somewhat in relation to the speed of the engine, and Mr. Cooper apparently advocates a long pipe for a slow speed engine. It is difficult to agree with him in this for the reason that it would seem necessary whether an engine is running fast or slow to have the steam condensed at the earliest possible moment in order to obtain the additional effort upon the piston at a point as near the beginning of the stroke of the engine as possible.

ALTHOUGH instances of unreasonable and arbitrary action on the part of members of trade unions are not wanting, some cases are worthy of special notice. One of this kind lately happened in connection with the plant of the Brown Hoisting & Conveying Machine Company of Cleveland. According

to our advices, it appears that on a recent Saturday morning a committee of the men waited upon the manager and requested that the afternoon be given them as a half holiday. The question was already under consideration, but the contracts of the company were such as to make it doubtful, in event of granting the request, if certain contract work could be gotten out on time, and a week's further consideration was asked for; but although not openly refused, when the noon hour came, all the men, numbering some seven hundred, walked out of the shop. The working men in general have too few holidays, and that these men in particular should have been permitted to lay off Saturday afternoons if they so desired will be admitted, but that working men have any right to abridge their hours of labor pending the completion of contracts predicated upon the existing basis, is denied. It is of course understood that every man in the works of the company in question had a perfect right to quit work on Saturday noon or at any other time he saw fit, but having so quit without the consent of the managers of the plant he forfeited all rights to re-employment on Monday morning. Had the managers in this case seen fit to employ other hands to take their places, no doubt a strike would have resulted, and then we would have heard of the right of appeal to arbitration, but it is difficult to see wherein the man who arbitrarily decides upon his own course of action has any right to insist that an arbitration committee shall decide for the other party. In the case in question the first issue was that of a half holiday. This the men decided of their own motion and without the consent of the company. Upon what ground would it be claimed that had the company chosen to discharge every man concerned in the affair, the men had any cause for grievance or ground of appeal to arbitration. This journal recognizes the fact that because of existing conditions, the laboring man is entitled to far greater consideration than he has been wont to receive, but it also believes that when the laboring man ignores the corresponding rights or others and assumes to regulate his own actions regardless of his obligations to others, he forfeits all right to anything but exact justice.

THE law concerning the use of track scales on grain shipments in the state of Kansas has been declared inoperative and the movement toward a clean bill of lading is temporarily checked in that state. On some accounts this is a fortunate outcome of the attempt to improve the conditions attaching to the shipment of grain. That a shipper is entitled to a clean receipt for whatever property he delivers to a railroad company is undeniable, but in the matter of bulk grain the difficulties attaching to the question are many and not easy of solution. It is not enough that the exact amount of grain loaded in a car be known at the shipping point. The out turn at destination must also be a determinable quantity, and in order to do this it is probable that some modifications of the present methods of handling grain both at the shipping and delivery points, will be necessary. Promiscuous delivery at the option of the shipper will certainly have to be abandoned for no railroad company can ascertain actual weights on delivery unless it can absolutely control same. Fortunately American ingenuity is making at least one part of the problem solvable. Automatic scales of absolute reliability both as to weight and record can now be obtained and the degree of perfection to which this matter has been carried is attested by one which has been in use in Chicago four years and which has weighed during that time over ten million bushels without a mistake in either quantity or record. The placing of scales of this character in the weighing room of country elevators, in charge of the agent of the railroad, under lock and key, would afford a means of absolutely determining the amount loaded into the car. Possibly a similar arrangement at delivery points in charge of official weigh masters or inspectors would give a corresponding service. Some different arrangement would of course be necessary for the handling of track grain, perhaps to the extent of exempting such shipments from the issue of clean bills of lading. It is obvious that any successful movement in this direction can only be accomplished through the united efforts of those most interested in the matter and possibly the surest and quickest way to reach this end is for the shippers to

equip their elevators with automatic weighing machines so arranged as to be absolutely under the control of the station agent, and then refuse to accept anything except a clean bill of lading on shipments. Should such a course be deemed desirable it should be done by the united action of the grain shippers after conference with the railroads; and in any event ample notice should be given to permit of adequate facilities for determining out-turn weights being established at the various terminals by the carriers. That some such arrangement will ultimately be adopted is beyond doubt, but how soon it shall be established is a matter which rests largely with the shippers themselves.

"RAILROAD ETHICS."

In the paper on "Railroad Ethics," presented to the Western Railroad Club by Mr. H. G. Judson, and which is published in this issue, are four points which seem to call for special notice. Not that the paper is in any sense weak for it is well worth the most careful study, but attention is called to these particular points by way of emphasis. With the paper, as a whole, no fault can be found. It is true that the title is somewhat broader than the subject, as only one particular phase of railroad ethics is therein considered, but that is perhaps a fortunate error.

It would appear that the only mistake made by the author in his treatment of the subject, is his position as to the selection of men. He says: "However good a fireman you may think a man will make, if you are satisfied he has not the capacity to become a competent engineer, don't employ him," and again, "a man may be strong and nimble enough to do duty as a brakeman, but if he has not the making of a good conductor in him, don't engage him." The position taken by Mr. Judson in this respect seems to be decidedly unethical. The truer policy is to give every man an opportunity to make the most possible out of himself. To refuse a man possessing only the capacity to make a first-class fireman the opportunity of doing this, is to work an injustice to him fully as great as if, possessing the additional capacity to become an engineer, he was not afforded the opportunity. So, also, in the case of the brakemen and conductor, cited by the writer in question. A man may make a good conductor who never has twisted the brake wheel. The one demands executive ability, while the other simply requires apprehension of duty and faithful adherence thereto, and to refuse to employ a man possessing the latter qualification because of his lack of certain other abilities, is to reduce the grade of the service as well as to inflict an unnecessary hardship upon worthy individuals.

It is of course better that a man should come up through the ranks to the higher positions in railway service, but it is by no means necessary to efficient service. Many of our best railroad officials know comparatively little—indeed nothing by way of actual experience—of the details of railroad service. No doubt they would be better officials, did they possess this knowledge, but other qualifications more essential being present, the lack of familiarity with details is properly not considered controlling. So also with the choice of men. They should be selected with due regard for the qualifications necessary for the duties to be performed. If such qualifications are supplemented by abilities of a higher order, these should be given preference when opportunity offers, but a man should never be refused employment in one grade of service simply because he lacks ability to be useful in a higher sphere.

As already stated, the above named point is the only one in the entire paper subject to adverse criticism. The paper abounds in valuable suggestion. The writer is almost epigrammatic in many of his utterances. "One way to have more conscientious men is to have more conscientious officials," is one of these. Mr. Judson recognizes the fact that the application of this principle involves a large amount of study and close association with the men on the part of those who manage them, but he is confident that, given patience and fortitude this will be repaid with much better results. So also his suggestion that "corporations ought to do more in the way of providing attractive rooms with congenial and beneficial surroundings at division points or wherever large numbers gather. It is probable that this work can

be best performed through the medium of the Y. M. C. A., as has been so thoroughly demonstrated by President Ingalls in connection with the Chesapeake & Ohio road. The true theory at the bottom of increased efficiency is the improvement of the personnel of the men and it is of little use to attempt much in the line of improvement during the hours of duty if the surroundings of the men when off duty are of a demoralizing character.

Possibly the most important and far reaching suggestion so far as it relates to the welfare of the roads themselves, is that of promoting a greater friendliness among the people at large by means of the influence exerted by the entire body of railroad men. If railroads are to prosper—and upon their prosperity depends the efficiency of the service they are to perform—this must be in some way accomplished, and for this purpose no better means can be used than to promote the hearty co-operation of the entire body of men in the railroad service.

STEEL RAIL FAILURES.

The physical character of steel is a subject which demands, and is now receiving, a great deal of attention, and there are good reasons for thinking that information which may be obtained from close study of this material, beginning at the blast furnace and extending through a number of years of the life of steel in such service as that to which it is subjected in the form of steel rails, is not by any means exhausted. There are remarkably few cases of failures of steel considering the vast amount of this material which is in use, and yet the accidents, when they do occur, are much more serious than formerly when traffic was slower, and the seriousness of derailment varies with a very high exponent of the speed. This fact is sufficient to warrant the expenditure of considerable energy in studying the causes of rail failures, such for instance as that at St. Neots, on the Great Northern Railway of England on November 10 of last year, an account of which was given in the RAILWAY REVIEW of March 7, 1896, page 134. There is yet something mysterious about this accident in which a rail broke into seventeen pieces and the exhaustive reports of the Board of Trade experts are not satisfying as giving an explanation of the remarkable occurrence. With heavy weights on driving wheels and having given thirteen and more years of continuous service, it would not be surprising to hear of the breakage of the rail, but how about those seventeen pieces with sixteen breaks across the rail, which in nearly all cases were square? Mr. Andrews explained the accident by a microscopical examination which showed a number of minute flaws in the steel which developed after the rail was put into service, through one of which the first fracture was believed to have occurred. On page 129 of the issue referred to, some microscopical flaws in steel are illustrated, magnified to a great extent. It is probable that Mr. Andrews' theory is correct but some other interesting investigations have recently been conducted in Germany which have an important bearing on the subject.

Under the caption, "Why do Rails Break?" the Railroad Gazette recently published a translation of a paper by Mr. A. R. V. Dormus, read before the Austrian Society of Civil Engineers and originally published in the *Zeitschrift des Oest. Ing. und Arch. Vereines*. These tests were made with a view of ascertaining the causes for the breaking of rails upon one of the Austrian trunk lines using basic Martin steel of two sections weighing sixty-three and seventy-one pounds per yard. These rails were found to stand drop tests satisfactorily and were brittle and hard when pulled in the testing machines. The conclusions based upon tests of fifteen rails rolled in 1893, are exceedingly interesting. It was found that test bars from the top of the rail have less strength but greater elongation than in other parts of the section, greater strength but less elongation was found with specimens cut from the center of the head. Pieces from the web have greater strength and greater elongation, and from the base, less strength and greater elongation were found. A second series of tests proved that the strength is fairly even all over the section near that rail end which is rolled from the lower end of the ingot, but the differences increase upon approaching the other end. The tests seem to disprove the opinion that as in rolling more work is exerted on the web than on the flanges and again

more on the flanges than on the head of the rail, therefore these degrees of effort are believed to correspond to different ultimate resistances and that the web is stronger than the flange, and the flange is stronger than the head of the rail. They also seem to disprove the theory that the wheel rolling process increases the density of the material near the surface of the rail.

A number of carefully prepared etchings were made which showed a clearly defined division of the rail into two parts, a shell and a core, with a distinct line of separation between the two and often the core was found to be porous as if worm-eaten. It is also interesting to note that after carefully checked chemical analysis, the strength was found to be greater in the bars having more foreign ingredients. The tests taken altogether are believed to prove that the great differences in strength occurring in the same rail section are caused by segregations in the ingot. The shell on the outside of the rail is found to be homogeneous and it corresponds to the rapidly hardening outside shell of the ingot. The core of the rail corresponds to the slowly hardening core steel of the ingot in which the segregation takes place to the greatest extent. The result of this mixture, as it might be termed, of elastic limits is seen in the broken rails. The highest test figures are obtained from bars taken from the web which contains mostly core steel and therefore show great strength and because the two layers of shell steel on the outside protect the surface of the bars against injury, that is against premature pulling, therefore test bars cut partly from the shell and partly from the core do not represent the true character of the steel. The reason for breaking when large segregations are present, is that this defect, as it may be called, produces a hard strong core with sometimes hardly appreciable elongation so that the core itself carries the load and the effective section of the rail is limited by the area of the core.

These experimenters conclude that longitudinal breaks in the rail heads are caused by vibrations produced by the rolling load. Shell shaped breaks in the head were shown by etching never to extend below the surface of the core and it is thought that they are due to a separation of the shell from the core at the hardening surface due to the cold straightening of the rails. The number of breaks is found to be much larger in new rails than in those which have been used for some time. The number soon becomes constant where it remains for some years and then increases again rapidly. The large number of breaks at first is the result of existing defects, and after these are removed the rails are thought to wear until the core is laid bare due to abrasion of the surface at which stage the rails break up frequently into a large number of little pieces, due to the brittleness of the structure. It is therefore to be inferred from these tests that the theory of deterioration of quality of the rail due to the action of the wheel is erroneous and rather than this the breakages, especially those which occur like that at St. Neots, are to be explained by the brittleness of the core which has its full effect after the tough exterior has been worn down. The St. Neots rail was worn down five-sixteenths of an inch before the accident and it would therefore seem that Mr. Dormus' theory is borne out in practice in this case.

This authority observes that a thick crust of shell steel appears desirable in the interest of safety. He also considers that the drop test is not an adequate method for testing steel which is subject to considerable abrasion, at least as long a steel practically homogeneous and always alike is not to be obtained. With reference to the chemical requirements, he refers to the mistake of specifying carbon only and does not consider chemical requirements advisable beyond limiting the ingredients which produce segregations by stating the maximum allowed percentage of phosphorus in the top butt end of the rail as well as an upper and lower limit for silicon. This writer does not incline to the opinion that the wheel-rolling process has the decided influence upon the character of steel which many authorities ascribe to it. He believes that by distributing the inequalities of the ingot over a long beam, they will become less apparent and they can be actually reduced by due caution in the blowing and pouring of the steel by its mechanical treatment

and by giving it the correct temperature in finishing and allowing it to cool properly. The argument involving the core theory is well borne out by the etchings made in this investigation and on some accounts it seems that herein are the best explanations for the peculiar failure in England. It is doubtful, however, as to the correctness of the inference that the rolling action of the wheels has no effect upon the character of the steel and this theory is difficult to relinquish even in the face of these exhaustive tests.

The Civil Engineers' Club of Cleveland.

At the meeting of the Civil Engineers' Club, of Cleveland, held May 12, 1896, Mr. E. A. Sperry read a paper on "Steam Engines for Direct-connected Electric Generators," describing his invention by means of which the generator makes two revolutions at each stroke of the engine. In the discussion which followed some interesting facts regarding rotary engines and steam turbines were presented. Messrs. R. L. Newman, S. W. Hayes, A. M. Waitt, C. O. Arey and W. B. Cowles were elected to active membership, and Messrs. W. J. Walker, S. B. Sheldon, H. P. Fairfield and Wm. Secher were elected to associate membership.

RAILWAY CORPORATIONS—RAILWAY RATES—LIMITATIONS TO THE STATES—CONTROL OF RATES.*

A. B. STICKNEY, President of the Chicago, Great Western Railway Co.

The problem which has engaged the attention of the American people as much as any other during the last 20 years is presented by the question: Has the government the right to control the rates charged by railway companies; and, if so, what limitations are there to the authority of the government in this respect?

The authority of the government depends upon the nature of railway corporations and upon the essential characteristics of the revenue they collect.

When the controversy commenced a quarter of a century ago, it was the contention on the part of the companies that railway corporations were private corporations, engaged in the private occupation of the "common carrier," and that the amount of compensation which they should receive for their services should be fixed by contract, expressed or implied, without interference from the government.

Granting the premises of their contention, the American people were in no condition to deny their conclusion; for if there is any economic principle which is universally admitted by this people it is that prices of all articles of commerce, including services (at least in their domestic commerce) must be fixed by the natural laws of untrammelled trade; that is to say, by free competition in the open market.

Early in the controversy, however, the advocates of governmental control disputed the private corporation theory, and after years of discussion the highest courts have decided that railway companies are not private, but *quasi* public corporations, and in this view the best thought of the country seems to coincide.

The distinction between a public and a *quasi* public corporation is obscure in the public mind. A *quasi* public corporation is a new identity.

Before the advent of railway corporations there were only two classes—private and public corporations.

A private corporation was an association composed of individuals created for the purpose of conducting some business which in its nature could be conducted by an individual; or, in other words, for the purpose of exercising an individual function, such as trading, manufacturing, or the carrying of goods for hire, either on the free highways of the sea or of the land, as the case might be.

The title to the property of the private corporation vested in the corporation and the members of the corporation were stockholders; in effect, owners of undivided portions of the common property.

A public corporation was a corporation organized for the purpose of exercising limited governmental functions. A county, a city, and a township, in America, are illustrations of public corporations.

The property within the jurisdiction of a public corporation was owned in severalty by the members, over which the corporation had a limited authority to incur with debt, to levy and collect taxes, and to exercise other governmental functions.

The principal difference, therefore, between a private and public corporation relates to the functions they were organized to perform and the ownership of the property.

When the controversy over the rights of the government to exercise control of railway rates arose, it became important to investigate the essential qualities of railway corporations.

Then it was discovered that a new class of corporations had come into existence, which had no name in the law dictionaries. It was found that railway corporations were technically neither public nor private, but possessed points of resemblance to both. In respect to form and the property they owned they resembled private corporations, but in respect to both the purposes for which they were organized and the functions they were authorized to perform they were public corporations. So for want of a better name the

courts called them *quasi* public corporations. The Latin word *quasi* is placed before English words to express resemblance. Hence a *quasi* public corporation means a corporation resembling a public corporation, or which is partly a public corporation.

The public characteristic of the railway corporation predominates, because the prime purpose of the organization is to perform a public or governmental function. It may be said that the particular governmental function which railway companies perform is of the first importance, lying at the foundations of the whole fabric of civil government. Indeed, it is not putting it too strongly to say it is necessarily coincident with the foundation of civilization. For the foundation of civilization is private ownership in land. The parting of the way between that nomadic condition which preceded and the civilization which followed began with private ownership of land. The first man who fenced in his quarter section of the earth's surface, and put up notices that he claimed to own it, and that he proposed to build on it a home for himself and his posterity, and to defend the possession against all outsiders, was the great forefather of civilization.

With the private ownership of the land came the necessity of highways. The two are inseparable; at least, the first cannot exist without the latter.

The individual ownership of land is not a natural right, in the sense that any man can trace the title of the land which he possesses back to a deed from the Creator, or in the sense that he is entitled to its possession because he made it.

Therefore it seems that the highest natural title to the land is vested in all the people in equal, undivided portions. But the same conditions which made governments necessary made it necessary that a limited individual ownership of land should be recognized, and in process of time the logic of civilization vested the paramount title of all the land in the sovereign or government, as the representative of all the people, the government in turn granting the right of possession of limited areas to the individual; but upon conditions.

One of these conditions is, that the sovereign or government, but no one else, may again take possession, by due process of law, and upon payment of a just compensation, of the whole or any part for a public use. The most important of the public uses for which land may be thus taken is for the purpose of public highways.

But there is no authority in the government, or in any one else, to take by process of law, or otherwise, private land for a private road or for any private use. The prerogative of sovereignty to take private property for public use, without the consent of the owner, is delegated to railway corporations, and without such authority it would be impracticable to build railways. This fact alone would seem to be conclusive evidence of the public character of railway corporations and that railways are public highways, created for the public use, and therefore should be open to the use of every citizen upon equal terms and conditions.

The fact that the power and duty of providing highways is exclusively and inalienably vested in the sovereign or government is the foundation fact, the fundamental principle, on which turns the right and duty of the government to control railway rates; hence all legislative enactments intended to exercise control of rates should be based upon this fundamental fact, and be built up consistently with the rights and duties of the government in exercising an exclusive power and prerogative.

There is another fundamental principle which should be taken note of at the same time, viz., that while a government can delegate the use of sovereign power to an agent, it cannot irrevocably alienate or part with a single sovereign power. Therefore all such powers exercised by an agent are subject at all times to the supervision and control of the sovereign or government.

Before proceeding further, as the whole argument turns upon these fundamental principles, it is proper to repeat, that the right to provide all kinds of highways, including the ordinary country road, the city streets, and the railroads, is a function and prerogative vested exclusively in the sovereign or government; that while the use of such function and prerogative may be delegated to an agent, they cannot be alienated, nor can the sovereign divest himself of the duty to exercise proper control over his agents in the exercise of such delegated functions and prerogatives.

The first question of the subject has been answered. Tersely stated, a railway corporation is a corporation created for the purpose of exercising a function and prerogative of the sovereign, under his license or as his agent, and subject to his control.

WHAT ARE RAILWAY RATES?

The second question, What are railway rates? will next be considered.

A great deal of confusion upon the nature of railway rates has crept into the minds of legislators, judges, and the common people, by the similarity between the services performed by railway companies and the services performed by "common carriers," and from this similarity of services, railway companies have come to be regarded as "common carriers," and railway rates have come to be regarded as of the same nature as charges made by "common carriers," i. e., as a *quantum meruit* for the specific service performed.

Issue is taken with both of these conclusions. A railway corporation is not a "common carrier" in the technical sense in which the words are known to the common law. Neither are the rates collected by railway corporations in the nature of a *quantum meruit*, or payments for specific services.

This proposition is not put forth as the settled law, for in the decisions of courts railway corporations are often

called common carriers. But, in sound reasoning, there is a broad distinction between the modern railway corporation and the common law "common carrier," and between the nature of railway rates and *quantum meruit*.

In this connection it may be stated that a failure to observe the distinction will lead the courts into a corner, from which they will be unable to extricate themselves until they back out and give due regard to the distinction.

The legislatures have enacted that all rates shall be reasonable and just, and if the courts shall hold that this language means that each rate shall be a *quantum meruit* for each specific service performed, it will become necessary for the courts to determine the value of each particular service on the basis of cost, which is impossible. There are so many ever-varying known and unknown factors which would necessarily enter into such a competition that all the railway experts, all the astute mathematicians, all the lawyers, all the politicians, and all the "grangers" cannot produce satisfactory evidence as to the reasonableness of any specific rate based on the cost of carriage.

It is safe to defy them all, individually and collectively, to give any good reason, based on cost, why a ton of coal should be hauled a certain distance for two dollars, while fifteen dollars is charged for the same service in reference to a ton of dry goods.

The cost of carrying dry goods may be considered more on account of the greater bulk and value, but the difference is not equal to the disparity of rates. The mysteries of a reasonable rate, in the popular meaning of the words, passeth all understanding.

And there is no way out of the corner except to recognize the distinction which exists between railway corporations and the "common carrier," and the broad distinction which exists between the essential characteristics of railway rates and a *quantum meruit*.

Having stated these propositions thus broadly, it is proper to examine the subject more minutely and see what basis they have to rest upon.

In the first place, the common carrier of the common law is an individual or a private corporation, transporting goods on the common highways, either on the land or sea, over which he has no control or exclusive right. He possesses and exercises none of the functions of the sovereign, and consequently has none of the duties of the sovereign to perform. His obligations, whatever they may be, rest upon his contract with his customers, expressed or implied. He can go in and out of the business whenever he chooses. In short, he is an individual,—a subject,—exercising ordinary individual or private functions in the same manner and governed by the same laws which apply to other private individuals. His rates are usually fixed in advance by express contract, and when perchance he does some service without expressly bargaining as to his compensation, the law says to him, as it says to every other individual in the absence of contract, "You must accept what your services are reasonably worth." This is the whole extent of the much-vaunted "reasonable compensation" which the "common carrier" is bound to accept.

On the other hand, railway corporations are public corporations, exercising the sovereign function and prerogative of taking private property for a public use, building, controlling, and operating, to the exclusion of all others, public highways. One is performing an individual function; the other a sovereign function. Each individual function performed may have a *quantum meruit*; but each sovereign function, never. The individual may trade, and even jockey; the sovereign, never. The individual may have favorites; the sovereign, never. The right of an individual to recover for services performed is based upon a contract expressed or implied, but the right of a railway corporation to recover for services rests, not upon the law of contract, but upon the license of the sovereign to collect tolls. This is logic, and it is law.

There is a long line of decisions in the highest courts, by the most eminent judges, who hold (quoting the language of one) that "the title of a railway company to its rights to demand compensation for this service is not derived to it upon common law principles, and is not to be measured by the rules of the common law; and whether it may lawfully demand compensation from a person who uses its highway for the carriage of goods, in the only way in which it can be used, depends upon the language of its charter, and not upon the rules of common law; and if its charter conferred the right to collect tolls, it could collect them. Otherwise, it is impossible to see upon what principle it could be contended that it was not compellable to permit the public to use it without paying tolls."

The decisions of the courts, as well as reason, make evident the essential characteristics of railway rates; they are not a *quantum meruit* for specific services, but tolls. A toll is a tax. Railway rates are taxes, and all the rules applicable to the levying of taxes are applicable to the levying of railway tolls or rates.

And when the acts of the legislatures which read that all railway rates shall be just and reasonable are construed by the courts to mean that all taxes levied by railway companies shall be just and reasonable under the rules pertaining to the levying of taxes, the insuperable difficulties of ascertaining the value of each specific service will be avoided, the courts will be let out of the corner and will stand on familiar ground.

The first step towards levying just and reasonable taxes is to approximate the aggregate amount required. This is done by estimating the operating expenses, and adding the fixed charges growing out of contracts to pay interest or otherwise. Thus the government of the United States each year estimates the gross amount required for the current expenses of the war department, the navy depart-

*Paper prepared for the Convention of Railway Commissioners, held at Washington, May 19, 1896.

ment the post office and other departments, for pensions, and for miscellaneous expenditures to the sum of which is added the amount required to pay the interest maturing on its bonded debt, and the grand total shows the just and reasonable taxes to be levied.

The several states ascertain in the same manner the amount of just and reasonable taxes which it is necessary for them to levy. The public corporations, such as counties, cities, towns, etc., which are authorized to levy taxes, pursue the same method; and as it has been proven that railway corporations are in the same category, it is evident that the first step towards levying just and reasonable railway taxes (rates) is to ascertain the aggregate requirements in the same manner.

At this point it seems necessary to digress from the main line of the argument on account of the confusion of the public mind upon the amount of interest and dividends which railway companies are entitled to collect, growing out of what may be styled the "watered stock" argument, if the illogical propositions put forth on this subject are entitled to be regarded as arguments.

The proposition is, that the aggregate par value of the stock and bonds issued by most, and perhaps all, railway corporations exceeds the amount that such roads could have been produced for with actual cash, and this excess is called "water," and it is claimed that railway companies should not be permitted to collect revenue to pay interest on mere "water."

The claim, coupled with the proposition in the foregoing form, has a certain air of plausibility. But it should be borne in mind that not a share of stock, a bond, or any other evidence of debt can be issued by a railway corporation without the previous consent and specific authority of the sovereign; therefore, according to all rules of commercial integrity, the claim is untenable. And certainly the sovereign is in no position to repudiate or question the validity of securities which have been issued in accordance with the express authority of the laws. Neither is the sovereign in position to plead that laws have granted a larger authority than was prudent, because that would be attempting to take advantage of his own fault.

The "water" claim can be taken with equal propriety against the securities issued by almost if not all counties, cities, towns, and other public corporations, as well as against the United States, and, in fact, all the sovereign powers of the world. For it may be safely asserted, that there is not one but what at some time has been compelled to sell securities at less than their par value.

A conspicuous illustration is found in the financial history of the United States during the civil war. The country in 1861 found itself engaged in a gigantic war, which required large expenditures for food, clothing, arms, and other supplies, and at the same time it was without money to pay for them. To raise the necessary money it had to do the same as railway corporations have to do—issue securities and place them on the market for sale. By the invention of the fiction of the "greenback," the government apparently sold its bonds at par, but in fact sold them at much less than par. I am personally acquainted with a beautiful landed estate in England whose present owner bought it out of profits which he made from buying United States bonds at about thirty-seven and one-half per cent of their par value and holding them till their value appreciated to par.

It is impossible to state with exactness, but it is probably safe to estimate that the par value of the United States bonds outstanding at the close of the war was fully twice, and perhaps three times, as much as it would have cost to conduct the war had it been conducted on a cash basis.

By the same process of reasoning which some apply to railway securities, probably from one-third to one-half of all the United States government bonds which were issued during the war period were "water," and therefore should not be paid, neither should the government be allowed to collect taxes for the purpose of paying the interest on "water."

The phenomenon of property costing more than it would have cost if it had been purchased for cash is not confined to governments or public corporations. What man is there who has not purchased property and agreed to pay in the future a larger sum than it would have been necessary to pay in spot cash?

It would evidently be subversive of all credit and of commerce if governments, corporations, or individuals were permitted to repudiate any part of their contract obligations on the grounds, that, if they had paid cash, they could have bought cheaper.

From this point of view the "watered stock" claim falls to the ground. It seems that the only tenable position is that all bonds and stocks of railway corporations which have been issued within the authority of law, without fraud, are valid obligations, entitled to payment according to their tenor, if they can be thus paid by the collection of the taxes (rates) which such corporations were authorized to levy and collect under their charters.

Hence it would seem clear that the aggregate taxes (rates) which railway corporations are entitled to collect (if they can, within the authority of their charters) is an amount sufficient to pay their operating expenses, the agreed interest on their outstanding obligations, and a reasonable dividend on their stocks. And such taxes would be just and reasonable.

But with a great many railway corporations, especially in sparsely settled districts, there are practical difficulties about collecting the full amount they would thus be entitled to, which will be considered later on.

Having determined the amount of the requirements, the next step in levying taxes is to determine upon what to base them. The sovereign has a wide range of discretion. Except constitutional limitations, there seems to be no limit to the sovereign's discretion.

The constitution of the United States contains few limitations upon the taxing power. Section 8 begins: "The congress shall have power to levy and collect taxes, duties, imposts, and excises, pay the debts and provide for the common defense and general welfare of the United States; but all duties, imposts, and excises shall be uniform throughout the United States."

Congress, therefore, may levy taxes on property, duties or imposts on imports, and excises on articles of domestic manufacture; about the only limitation seeming to be uniformity. The states have likewise an almost limitless field, subject also to the rule of uniformity and impartiality. But the field of agents of the sovereignty—the public corporations, such as counties, cities, towns, and railway corporations—is strictly limited to the authority given in the charters which create them.

The authority of counties, cities, and towns usually extends to levying a percentage tax on the value of the property within their jurisdiction, a poll tax upon the inhabitants, and a license tax upon various occupations. The authority of railway corporations is limited to tolls in respect to the persons and the tonnage transported.

The next step in levying taxes is a consideration of the very practical problem, as to whether the field of authority is large enough to collect taxes equal to the requirements. In the case of the railway corporation, the inquiry would be: Does the railway have, or can it procure, a sufficient volume of traffic to enable it to collect enough revenue to meet its requirements? This dilemma is not presented to railway corporations alone. The highest potentates and the richest governments are frequently brought face to face with this practical problem. In fact, many of the sovereign governments of the earth are chronically affected with such practical difficulties in raising necessary revenues.

When the condition of all the governments and the public corporations, and especially railway corporations, is considered from this point of view, they are found to naturally divide into two classes—"the cans" and "the can'ts."

Many of the governments of the world belong in the "can't" category, and go on from year to year borrowing money at extravagant rates of interest, piling up indebtedness which will end—the good Lord only knows how. For several years during the civil war, the United States was in the "can't" class, and piled up a bonded debt of huge proportions.

Many countries, cities and towns, have at times been in the "can't" class, and have been compelled to compromise with their creditors.

Perhaps it is unnecessary to say that many railway corporations have been, and now are, in the "can't" class, and it seems probable that some of them always will belong in that class. But that is neither here nor there, except so far as it affects the rule of taxation, which will soon be considered. The holder of the securities of "can't" corporations took the "can't" risk when they bought them, and are entitled to no consideration on that account. Such corporations are entitled to collect just such taxes (rates) as they can in fact under the authority of their charters, and no more; but they are entitled to collect all they can.

Having determined the aggregate amount of just and reasonable rates, and on what they can be levied, the next step is to determine the distribution as between the different classes which are subjects of taxation, or, in common parlance, the individual rate.

Before proceeding with the discussion of the method of distributing taxation, the gist of the whole contention as to the meaning of just and reasonable taxation should be stated as tersely as possible.

It is the contention that just and reasonable rates are determined by the aggregate just and reasonable requirements. The aggregate has relation to aggregate cost of operation, because it is made up by adding to the cost of operating the interest and dividend charges. But a single rate has no relation to cost. A single rate may be just and reasonable which is less than cost, and a single rate which is several times the cost may also be just and reasonable. Thus it is that two dollars may be a just and reasonable rate for hauling a ton of coal, while \$15 is also a just and reasonable rate for like service in respect to a ton of dry goods, although the cost of each service is substantially the same.

The aggregate taxation of the government of the United States in order to be just and reasonable must have relation to the cost of carrying on the government; but the rate of duty on any class of imports has no relation to such cost.

When congress comes to determine what rate shall be paid upon a gallon of whisky, it does not stop to ascertain, or even to consider, what proportion of the expenses of government is due to that gallon of whisky. Or when it decides what rate of duty shall be paid upon the importation of artificial flowers, it does not undertake to find out what part of the cost of carrying on the government is due to the wearing of flowers in ladies' hats.

The particular rates of duties, imposts and excises have no relation whatever to cost of any kind, either specific or average.

This is a general principal which runs through the distribution of all kinds of taxation. The distribution of taxation is under some conditions determined by public policy, and under other conditions by the law of possibility. With those governments and corporations whose field of taxation is so large that it is easily possible to collect sufficient revenue to meet all requirements, reasons of public policy may prevail. On the other hand, with those governments and public corporations whose field is so small that it is difficult or impossible to raise sufficient revenue, the law of possibility controls.

Take, for illustration, the national government, whose general policy is to raise the bulk of its revenue from duties on imports—a form of taxation most closely resembling the taxes levied by railway corporations. The importations into the United States are so large and of such a class that there is no practical difficulty in collecting more than is required.

Hence, for reasons of public policy, some articles, such as are regarded as necessities, are admitted without tax; others that are regarded as luxuries are heavily taxed; and still others which it is thought desirable to have produced in this country, are protected by so large a tax that it almost prevents importation, and therefore does not produce so much revenue as a smaller tax would produce. A country rich relatively to its requirements in taxable resources can thus consider public policy.

But let condition change about. Let the volume of imports decrease until it becomes difficult to get sufficient revenue. Then the law of possibility would control. The distinction between luxuries and necessities, or the policy of protection of home industry, could no longer be regarded. The necessities of the government would compel it to scrutinize the possibility of each class of imports as a revenue producer, and such a rate of duty (neither too low nor too high) would have to be applied to each as would bring the largest revenue.

In this connection it is well to recall the fact, that taxes in the nature of duties and railway rates may be too high, as well as too low, to produce in the long run the maximum revenue. Consider a single example. There is now imported annually into the United States about 3,500,000,000 pounds of sugar, and an impost tax of one cent per pound will give the government the enormous revenue of \$35,000,000 from sugar alone. But let the duty be raised to, say, five cents a pound, and in a few years the government would receive no revenue whatever from the importation of sugar. Not because the American people would stop consuming sugar, but because a sufficient quantity would be produced in this country cheaper than it could be imported.

The same principle applies to railway rates. It is as possible to get them too high as too low to produce the largest net revenue. If too high, they will stop production, and that would stop transportation, and, as has been shown and is evident, railway corporations cannot collect rates on what they do not transport.

Hence with that large class of railways in the newer and sparsely settled districts which "can't" collect sufficient revenue to meet all their requirements, the correct rate on each class and commodity is that nicely adjusted rate, neither too high nor too low, which will produce the largest revenue.

And it is the contention of this argument, that, whenever the question of the reasonableness of a rate is presented, in respect to a railway company which is not collecting sufficient revenue to meet all its requirements, it is only necessary for the court to inquire and determine whether or not the rate is too high or too low to produce in the long run the greatest possible revenue from the class of traffic to which the rate applies. This is the only question involved in the problem of a reasonable rate under such conditions.

If the inquiry arises in respect to a railway corporation which is collecting a larger aggregate revenue than is just and reasonable, the nice adjustment of the rate for the purpose of producing the maximum results may be disregarded, and the aggregate revenue may be decreased by either raising or lowering the rate, as the reasons of public policy may demand.

LIMITATIONS OF STATE CONTROL.

At this point in the argument the duty of the sovereign in respect to control and the limitations of his power may be discovered.

If the premises are correct, the railway and municipal corporations are of the same class. Their rights of contracting obligations and issuing evidences thereof, and of collecting taxes for the purpose of fulfilling their obligations, stand upon the same foundation. Therefore the sovereign's duty and right of control is the same over railway as over municipal corporations; no more, no less.

In regard to contracting obligations, it is the sovereign's right and duty to confine such corporations to the authority which has been granted to them.

In regard to the collection of taxes, it is also his right and duty to see to it that their authority is strictly pursued, that their taxes are levied with uniformity and impartiality, and that they do not collect more revenue than the law allows. And it is equally the sovereign's duty to compel them to collect all the law does allow, if the maximum collection is necessary to meet their obligations, and if the field for taxation is large enough to permit it.

The latter proposition is a well recognized principle of law in respect to municipal corporations. If such a corporation has issued bonds, and its governing board wantonly refused to levy and collect sufficient taxes to meet the interest obligations of such bonds, upon application of any bondholder, the court will issue its writ of mandamus to compel the levy and collection of a proper tax.

It is submitted, that, when the governing board of a railway company wantonly refuses or neglects to levy sufficient rates to meet its obligations, upon the application of any obligee, it is equally the right and duty of the court to issue its writ in like manner to compel the members of such governing board to do their duty, and if the condition of the company is such as to require the maximum collection, to compel them to adjust the rates, either by raising or lowering them, as the case may require, so as to produce the largest possible revenue.

The last proposition is perhaps novel. It is certain the courts have never taken such action, and as far as known, such relief has never been sought in the courts. But it would seem that the holders of railway securities have a clear case of right, supported by reason and by the letter

f the law, if its words have their reasonable and ordinary significance. For the law of congress says (and the laws of the states have similar provision) that all railway rates shall be "reasonable and just," and "every unjust and unreasonable" rate is prohibited and declared unlawful.

The question is, if a rate which is too high is "unreasonable and unjust," is not a rate which is too low equally "unreasonable and unjust?"

It is the highest duty of the sovereign to do justice. Distributive justice belongs to the sovereign and consists in giving to every one that right or equity which the laws and the principles of equity require. The right of the state to control railway rates is limited by the obligations of justice. The general principles of the laws and of equity pertaining to the determination of railway rates, have already been stated.

Western Railway Club.

At the annual meeting of the Western Railway Club, held in Chicago, on May 19, the following officers were elected: President, A. M. Waitt, general master car builder, L. S. & M. S. Ry.; 1st. vice president, F. A. Delano, superintendent freight terminals, C. B. & Q. Ry.; 2d. vice president, E. M. Herr, assistant superintendent motive power, C. & N. W. Ry.; member executive committee, Peter H. Peck, master mechanic, C. & W. I. & B. Rys.; Mr. J. N. Barr, superintendent motive power, C. M. & St. P. Ry. At the meeting of the executive committee, held immediately succeeding that of the club, Mr. Walter D. Crozman, editor Railway Master Mechanic, was chosen secretary.

Arrangements have been made with the Wagner Palace Car Company for running sleepers direct from Chicago to Saratoga for the Master Car Builders' Convention. Sleeping cars will be attached to the Lake Shore & Michigan Southern train which leaves Chicago at 10:30 a. m. on the 15th of June. Persons wishing to take advantage of this arrangement should send their names at once to Mr. A. M. Waitt, master car builder of the Lake Shore & Michigan Southern Railroad at Cleveland, Ohio, who will be pleased to reserve accommodations as requested.

TECHNICAL MEETINGS.

Association Railway Claim Agents, May 27, Monongahela House, Pittsburgh, Pa.

International Association Car Accountants, June 9, Cleveland, Ohio.

Annual convention Master Car Builders' Association June 17, Saratoga, New York.

Annual convention American Master Mechanics' Association, June 22, Saratoga, New York.

Association American Railway Accounting Officers, May 27, New York City.

Association Railway Telegraph Superintendents, June 17, Fortress Monroe, Va.

American Association General Baggage Agents, July 15, Philadelphia, Pa.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p. m., at the House of the Society, 127 East Twenty-third street, New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The International Irrigation Congress will hold its fourth session at Albuquerque, N. M., September 16-19. Fred L. Alles, secretary, Los Angeles, Cal.; local secretary, W. C. Hadley, E. M., Albuquerque, N. M.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each month, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West thirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumberland Publishing House, Nashville, Tenn.

Annual meeting Traveling Engineers' Association, Minneapolis, Minn., Sep. 8, 1896. W. O. Thompson, secretary 415 Marion street, Elkhart, Ind.

Annual Convention Roadmasters' Association and Road and Track Supply Association, Cataract Hotel, Niagara Falls, N. Y. second Tuesday in September, 1896.

The Railway Signaling Club holds its meetings in Chi-

cago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southwestern Society of Mining Engineers will hold a session at Albuquerque, N. M., September 16-19. Walter C. Hadley, secretary, Albuquerque, N. M.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T. Johnstone, 1522 Monadnock building.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at the Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

PERSONAL.

Mr. H. A. Kimball has been appointed general agent of the Great Northern at Minneapolis.

Mr. J. T. Atwood, it is stated, will succeed Mr. House as chief engineer of the Pittsburgh & Lake Erie.

Mr. A. S. Dunham, general manager of the Ohio Southern, has resigned and the office has been abolished.

Mr. Page Cherry, of Newark, O., has been appointed general dairy agent of the refrigerator car service of the Baltimore & Ohio at Chicago.

Mr. J. W. Hunter has been appointed traveling freight and passenger agent of the Georgia & Alabama Railway, with headquarters at Montgomery.

Mr. S. D. McLeish has been appointed general southwestern agent of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Evansville, Ind.

Mr. C. B. Cleveland has gone to the City of Mexico, where he will represent the Louisville & Nashville and the Atlantic & Mexican Gulf Steamship Company.

Mr. C. Peter Clark, general freight agent of the Old Colony, system, has been appointed assistant general manager of the New England road from June 1.

The Chattanooga Southern road has been taken out of the hands of a receiver and Mr. M. F. Bonzano appointed general manager by President H. A. V. Post, of the company.

Mr. F. K. Fransioli, who has been chief clerk in the office of the general manager of the Manhattan Railroad Company, has been appointed general manager to succeed the late Col. F. K. Hain.

It is reported, but not officially so, that Mr. W. H. Burns, general manager of the Montana Union, will be made General Manager of the reorganized Utah Northern & Oregon Short Line.

Mr. H. E. Farrel, for some years chief clerk to General Freight Agent R. S. Davis of the Cotton Belt, has received the appointment of assistant general freight agent of that company, with headquarters at St. Louis.

Mr. J. T. Odell, formerly general manager of the Baltimore & Ohio, and until recently vice president and general manager of the New York & New England, has resigned to become president of the Butler & Pittsburgh road.

Mr. Frank A. Jackson, who for a number of years was the representative of the Santa Fe in Buffalo, has been appointed traveling freight agent of the Western Transit Company and Anchor Line, with headquarters at Cleveland.

Mr. Joseph Dickson of St. Louis has been appointed receiver of the Litchfield, Carrollton & Western vice Mr. Charles H. Bosworth resigned. Mr. Dickson is also receiver of the St. Louis, Chicago & St. Paul Railroad Company.

It is reported that when the Illinois Central assumes charge of the Chesapeake & Ohio Southwestern next month Mr. W. A. Ellmond will become passenger agent in charge of all the business south of the Ohio river. Mr. Ellmond is now assistant general passenger agent at New Orleans.

Mr. Gilbert Harris, who has been with the Chicago, Burlington & Quincy for 18 years, the last three years as its representative at Kansas City, has resigned to go into other business. Mr. Harris began 18 years ago as a messenger boy in the company's office at St. Joseph, Mo.

On May 15, Mr. L. F. Barton, general roadmaster of the Louisville, Evansville & St. Louis, resigned that position, as did also Mr. Harry Mellers, purchasing agent, and Mr. E. M. Hibbard, treasurer. The duties of general roadmaster will be discharged by Chief Engineer T. A. Allen, while those of purchasing agent will be attended to by Receiver Jarvis.

Owing to the protracted illness of Mr. F. L. Sheppard, general superintendent of the Pennsylvania Railroad Division, the directors of the company have granted him an indefinite leave of absence, and appointed Mr. J. M. Wallis, at present superintendent of motive power on the division, acting general superintendent during Mr. Sheppard's illness.

It is stated that Mr. A. E. Robbins who has held the position of superintendent of the Toledo division for some years, has tendered his resignation and will retire from the railway service to his farm near Eaglesfield, Ind. Should the resignation be accepted it is understood that there will be quite a rearrangement in the transportation department of the road.

Mr. E. S. Washburn, vice president of the Kansas City Fort Scott & Memphis has been elected president of the Kansas City Belt Railway and Kansas City Union Depot Company, succeeding the late George H. Nettleton. It is expected that Mr. Washburn will also succeed Mr. Nettleton on the Gulf road but as yet no appointment to that position has been made.

At a special meeting of the board of directors of the Pittsburgh & Lake Erie Railway held in Pittsburgh on May 15, Colonel J. M. Schoonmaker was elected president, vice ex-Judge James H. Reed, resigned to become president of the Butler & Pittsburgh, the new Carnegie line to the lakes. Colonel Schoonmaker was formerly a coke operator, and sold out to H. C. Frick.

Mr. I. H. Burgoon of the Utah Central has been appointed general superintendent of the Ohio Southern, vice A. S. Dunham, general manager whose office has been abolished. Mr. Burgoon entered railroad service as office boy to the president of the Fremont & Indiana Railroad. Since that time he has been in the business constantly, holding some very responsible positions, among which were general superintendent of the Lake Erie & Louisville, general superintendent of the Toledo, Delphos & Burlington, general manager Cleveland, Delphos & St. Louis, receiver and general manager of the Bellaire, Zanesville & Cincinnati, and general manager and treasurer of Terre Haute & Peru Railroad.

RAILWAY NEWS.

Bellaire, Zanesville & Cincinnati.—Reports say that the Bellaire, Zanesville & Cincinnati R. Co. is contemplating extensive improvements during the present year and that when they are completed the road will be in better condition than it has been since the road was built in 1884. Among the improvements are the following; over 600,000 ft. of lumber, 300,000 ft. over last year's amount will be used this year for building of trestles and bridges; 40,000 cross-ties were used last year, and 60,000 will be used this year. Over 17 miles of steel rails will be laid down on the western division of the road, which will only leave 17 miles of iron rails, and that will be between Summerfield, Noble county, and Woodsfield, Monroe county, Ohio. The company has purchased new coaches and a large number of box cars from Addison, New York & Pennsylvania R. Co., which will be placed on the road as soon as the work is finished. It is stated that more lumber is sent over that road to Pittsburgh, Pa., and Columbus, Ohio, than any other road of 112 miles of the state of Ohio. The principal places from which the lumber is shipped are from Beallsville and Woodsfield, Monroe county.

Buffalo, Rochester & Pittsburgh.—The coal deal between the Buffalo, Rochester & Pittsburgh Railroad and the Bell, Lewis & Yates Coal Co., of Rochester, N. Y., in the coal mining districts of Clearfield and Jefferson counties in Northern Pennsylvania, by which the railroad acquires the coal fields of the company, will make the road the most extensive operator in the coal fields of that territory, giving it practical control of the output and shipments from that district. The property transferred includes nearly 12,000 acres of coal lands, the mines having a capacity of 10,000 tons daily. There are in addition 100 coke ovens. The Bell, Lewis & Yates Company has been one of the largest bituminous coal mining concerns in the country. In addition to the coal properties the purchase includes a few railroads the Reynoldsville & Falls Creek, 15 miles long, from Falls Creek to Rathmel, Pa., and a three-mile branch road called the Falls Creek from a town of that name to mines. While the Bell, Lewis & Yates Company has been shipping much of its output over the Buffalo, Rochester, & Pittsburgh, yet the Erie has had a fair share of the traffic and the Western New York & Pennsylvania has been getting a slice. Now the Buffalo, Rochester & Pittsburgh can carry all the coal and dictate terms to the other lines. Moreover, the cities of Rochester, Buffalo, and Cleveland may be affected, if the new owners decide to advance the price of soft coal for that district.

Cincinnati Tunnel Ry.—The Cincinnati Tunnel Ry., which was sold under foreclosure at Cincinnati on May 19, was purchased by Mr. Ira W. Bellows for \$50,000. Mr. Bellows represents the new Brice line to Chicago via Cincinnati, Jackson & Mackinaw and Baltimore & Ohio, and the completion of this tunnel will give the new line an excellent entrance into Cincinnati.

Green Bay, Winona & St. Paul.—This road which was last week sold under foreclosure will continue to be operated as an independent line by the new company which will soon be formed, and not absorbed by another system as reported. By the reorganization plan to which, it is said virtually all of the bondholders have consented, the road is to be placed upon a sound basis by the expenditure of large sums of money necessary to place the property in good condition. The plan, it is stated, also contemplates the extension of the line from Merrillan to St. Paul, following the original route that was mapped out years ago and the right of way which is largely owned by the company. The plan for reorganization, however, will not be carried out without opposition. Before leaving New York the attorneys secured an order from Judge Seaman, in the United States Court, citing all parties to show cause, if they have any, particularly William S. Mowry, why the sale of the road should not be confirmed. The order is made returnable on June 1. Mr. Mowry represents first

mortgage bondholders to the amount of \$105,000, who refused to go into the reorganization agreement in 1892 and who want to receive the full amount of their holdings with interest.

Jacksonville, Louisville & St. Louis.—The date for the foreclosure sale of the Jacksonville, Louisville & St. Louis road has been set at June 10. The sale is for the purpose of satisfying a mortgage of \$1,000,000. Mr. P. Barton Warren is appointed special master.

Mexico, Cuernavaca & Pacific.—This road which is being built by the Mexico & Acapulco Construction Co., City of Mexico and Denver, is projected to run from City of Mexico to Acapulco, a distance of 350 miles. Grading is completed from City of Mexico to Coajomulco—50 miles—and also from Puento de Yxtla to Buena Vista—40 miles. The track is laid from the City of Mexico to Tres Marias—47 miles—and is in progress from Puento de Yxtla south. Two thousand men are at work on that section and another large force is grading south from Tres Marias.

Seattle, Lake Shore & Eastern.—At noon on May 16, the Seattle, Lake Shore & Eastern road was sold under foreclosure at Seattle, and was purchased by Judge H. G. Struve, representing the bondholders' committee, for \$1,000,000. It was expected by many that the Canadian Pacific would have a representative on hand. The outstanding bonds against the road amount to more than \$5,500, and any other bidder would have had to meet the bondholders, who are given the right, under the decree of court, to apply the bonds on the purchase price.

Wisconsin & Michigan.—In connection with this road will be operated the lines of car ferries belonging to the Green Bay Transportation Co. This company is now building docks at Oconto and buying right of way between the bay front and the city—a distance of 2 miles. This company recently purchased a car ferry from Cleveland parties, which will soon be on its way to Green Bay, and will probably be running on the regular route between Oconto, Green Bay and Peshtigo before many weeks.

Wisconsin Central.—Work on the Manitowoc extension of the Wisconsin Central is now in progress. The line will be about 25 miles in length, running from Hilbert Junction to Manitowoc. A considerable portion of the grading is already done, and the work of laying ties and rails has begun at the Hilbert Junction end. A number of side tracks are also being put in. The Central people will use the Chicago, Milwaukee & St. Paul tracks from Menasha to Hilbert Junction, and, in turn the Chicago, Milwaukee & St. Paul people will operate on the Wisconsin Central Co.'s track between Menasha and Oshkosh. This will give the former company connections with another branch of its line, making a connecting link as it were, which will doubtless prove a great convenience in many ways. It is expected the extension will be completed by the 1st of July.

NEW ROADS AND PROJECTS.

Arkansas.—The engineers who are surveying the route for the Sunny Side, Hamburg & Western. Mr. Austin Corbin's new road, have now reached a point 8 miles east of Portland and are now moving west at the rate of a mile a day.

Central America.—According to press dispatches the legislature of Honduras, Central America, has granted protection to the patent required by Mr. J. V. P. Ritter, of Washington, D. C., to organize a railroad company to build a road through that state. Mr. Ritter has been for several months in Honduras in the interests of his new road, which is designed especially for mountainous countries. The track is based on the plan of a large cable, on which is suspended the cars, and trains can be run from one mountain to another without trestling or bridging. The road can be constructed much cheaper than the ordinary railroad and is said to be pronounced feasible and safe by the best engineers.

Colorado.—It is reported that the Denver & Rio Grande will build two extensions of its line in the near future. One will start at Durango, and run in a general southerly direction down the valley of the Animas river to the San Juan river in New Mexico, where it will turn off in a westerly direction. This will be known as the Rio Grande-Durango Southwestern. The other, the Rio Grande-Delta R. Co., will run from Delta through the valley of the Gunnison river and by the most feasible route to the coal camp of Carbondale in Garfield county, Colo. Separate companies will be organized to build the lines, each company having a capitalization of \$250,000. The incorporators for both companies are Messrs. Edward T. Jeffery, Andrew S. Hughes, Charles H. Schlacks, John B. Anderson and Merritt H. Rodgers.

Florida.—At a meeting of the stockholders of the Fernandina Western road, held last week, the following officers were elected: President, N. B. Borden; vice president, Patrick Kelley; treasurer, Fred W. Hoyt; general manager, Jas. McGiffin; secretary, E. W. Bailey. President Borden, while realizing the many difficulties to be encountered, enters on his duties with a determination to push the work until the road shall be in operation—and believes the outlook is now better than it has ever been. Between 40 and 50 large foreign steamships visit Fernandina annually, and these desire freight for their extra space. The phosphate business will remain with Fernandina, if the indications of the past and present count anything, for the shipments have grown steadily in spite of the severe business depression of the past two or three seasons. The proposed railroad will touch the finest timber in the south, that of the Okefenokee country; and the people interested in the project believe that the opportunities are increased

of finding capitalists who will recognize the advantages which this deep-water port offers to exporters.

Indiana.—The survey for the new line which is to be built in the interests of the Wabash will be begun this week. The road is for the purpose of securing a direct line for the Wabash between Peru and Detroit, and will be called the Kendallville, Ashley & Peru R. It is expected that the construction will begin in the near future.

Michigan.—The branch of the Michigan Central, already mentioned in this column, which is to be built into Petoskey, is now an assured fact, and the construction cars belonging to Butler & Breen, which have been idle in Petoskey since the completion of the Chicago & West Michigan to that point three years ago, have been loaded for shipment to Wolverine. It is promised that the new line, which will be about 20 miles in length, will be completed before another winter.

Minnesota.—Another road which is projected in Minnesota to run from Duluth to the Missouri river in North Dakota, is the Duluth & Great Western. It is said that although only the preliminary steps have as yet been taken, that a number of Eastern capitalists are interested in the enterprise and that the road is an assured fact. George H. Mansfield, of Greenfield, N. H., representing Eastern capitalists, is president; Caleb S. Cox, Hubbard, Minn., vice president; Isaiah H. Bradford, Hubbard, Minn., treasurer; John A. Keyes, of Hubbard, Minn., secretary; these, together with Edward H. Spalding, of Duluth, are the first board of directors. The territory through which this new line is projected contains some of the best wheat country in Northern Minnesota and Dakota. The capital stock \$100,000.

New York.—The Binghamton & State Line is a line projected to run from Binghamton to Monogahaus, N. Y., a distance of 13 miles. The line is already graded from Monogahaus northerly to Ingraham Hill—5 miles—and negotiations are now in progress which it is thought will result in the resuming of work on the line in the near future, although it is now temporarily suspended. At the same time, work on the extension into Pennsylvania under the name of Binghamton, Pennsylvania & Southern, will be taken up and pushed through to Wyalusing in Bradford county, with the ultimate intention of continuing it to Dushore, in Sullivan county. The line from Binghamton through to Wyalusing is already located and maps, profiles and bridge plans have been prepared in detail. In speaking of this road one of the officials says: "This is absolutely the best unoccupied territory in any eastern state. Local traffic would much more than justify construction, as large coal contracts can be made in advance of construction, and it will be a link in a trunk line from Cincinnati, Pittsburgh, Binghamton and Albany to the New England States, the shortest possible route. Arrangements could be made to give contract to anybody who could put say \$50,000 into the enterprise, and a free right of way through to Dushore, five miles of grade and line, and other inducements that will make it a first-class opportunity for investment could also be given. We lack but little of being able to go on with it now." Erastus Ross, of Binghamton, holds the contract for the construction of the line from Binghamton to Monogahaus.

Articles of incorporation have been filed with the Secretary of State by the Missouri River Construction Co. The purpose is to equip and construct railroads. The main office is to be located in New York city, with a branch office in Kansas City. The directors are Theodore Gilman and Winthrop Gilman of New York City; Edward T. Statesburn and George C. Thomas of Philadelphia, and Arthur E. Stillwell and John McTrimble of Kansas City. Capital stock, \$300,000.

Texas.—The charter for the Chicago, Weatherford & Brazos Valley R. Co. has been approved by the attorney general and filed in the office of secretary of state. Reports come from the engineering party who are about 12 miles northwest of Weatherford that they have so far found a good line and that the road can be built easily at a reasonably cost.

It is now said to be an assured fact that the extension of the Texas Midland will be built to Paris and possibly a southern extension to Waxahachie. President Green's proposition to Paris was that the city should provide right of way from the Delta county line to the Frisco depot, sufficient grounds for depot purposes, a spur to the compress and oil mills and \$30,000. The first proposition demanded forty acres for shop purposes but this has been modified and the donation of this ground is to be optional with the city. A corps of surveyors will be put in the fields at once and the promise has been given to begin work within 30 days. The road is to be eventually extended to Little Rock, Ark., from Paris via Hot Springs.

INDUSTRIAL NOTES.

Cars and Locomotives.

—The Cincinnati, Jackson & Mackinaw road is in the market for 50 furniture cars.

—We understand that the Maryland Steel Works, of Baltimore, has completed the Strong balanced compound locomotive they have been building, and when in good working order it is to be sent to Purdue University to be tested by Prof. Goss.

—The Chicago & Northwestern is said to have placed an order for 1,000 freight cars with the Haskell & Barker Car Co., and to contemplate ordering several thousand more.

—The first steel beam rolled by the Universal Construction Co. of Chicago, was turned out May 19. The beam, a 12-inch one was rolled in the North Chicago Rolling Mills of Illinois Steel Co., now operated by the Universal Construc-

tion Co. The mill, which will start on regular work on May 25, is the only one now running west of Pittsburgh able to supply structural material of all kinds.

—It is stated that the Paige Car Wheel Works, of Cleveland, O., will be enlarged at a cost of about \$20,000.

—The Erie Railroad is building a coal car of 80,000 lbs. capacity which will be equipped with automatic devices for dumping.

—Arrangements are under way for the erection of car works at Savannah, Ga., to cost upwards of \$100,000.

—The American and Canadian patents relative to the King brake beam invented by Charles B. King, Detroit, Mich., have been sold to the American Brake Beam Co., of Chicago.

—Of the 1,000 coal cars recently ordered by the Lehigh Valley Railroad Co., 500 are to be equipped with the Marden brake beam and 500 with the Kewanee brake beam.

—Moran Scott, receiver of the Denison & Northern, Dougherty, I. T., has been authorized by the court to purchase six 10-wheel freight engines, 10 box cars, four cabooses, 250 gondola cars, and 10 hand cars, and tools therefor, to be paid for out of an issue of receivers' certificates.

—The Jackson & Sharp Co., railway and tramway car builders, of Wilmington, Del., has opened offices in London, at 13 St. Ermins Mansions, Westminster, and are prepared to tender for passenger and goods car of any description.

—James S. Whitney, trading as A. Whitney & Sons, manufacturers of car wheels at Sixteenth and Callowhill streets, Philadelphia, has made an assignment for the benefit of creditors to William G. Neilson. The deed conveys a considerable amount of real estate, but no schedule of assets and liabilities has yet been prepared, though the appraisers are now at work.

—The Brooks Locomotive Works has turned out for the St. Lawrence & Adirondack road a freight engine of mastodon type, with 21 x 26 cylinders.

—Mr. E. E. Macbeth, manager of the Cold Blast Transportation Co., has been in Chicago during the current week in reference to placing an order for 100 refrigerator cars for that company.

Bridges.

—The city authorities at Raleigh, N. C., have notified the Southern Railway Company to construct a better and stronger iron bridge over its tracks at the intersection of South street and the company's tracks, with which order the railway company expresses its readiness to comply.

—The great project of bridging over Palk's strait, separating the island of Ceylon from the mainland of India, for which such important advantages are claimed, is said to be again under consideration by the government of Ceylon. This strait is some forty-one miles broad at its narrowest point, being double the width of the English channel, but it is very shallow, in many places being not more than six feet deep. The islands, reefs and channels in it have been recently accurately surveyed and mapped, and the cost of the work, extending over 61 miles, including the Pamban channel and the Adam's bridge reef, is estimated to reach some 28,000,000 rupees. The plan of work contemplates the connection of the ends by 145 miles of railroad with Colombo, the great harbor of Ceylon, on one side, and by 90 miles of road with Modura, the nearest point of the Indian railroad system, on the other. If narrow gauge is used this can be done, it is calculated, for 11,000,000 rupees more.

—An iron and steel bridge, to be built with reference to strength especially, will be erected across the Kanawha river at Deepwater, W. Va., by a new railway and coal company just formed and known as the Glenjean Lower Loup Creek & Deepwater R. R. Co., with the view of connecting the railroad with the Kanawha & Michigan R. R., on the other side of the river.

—The plans of the new bridge across the Allegheny river at Freeport have been accepted on condition that the counties of Westmoreland and Armstrong rebuild the bridge when the Allegheny shall have been slackwatered and navigation opened to that point. The present plans call for a 300 foot span, with an elevation of 45 ft. above low water. When the river is made navigable the bridge must be raised to 53 ft. above low water, with a span of 500 ft.

—The Illinois Central Railroad Co. is building a new iron bridge near Red Oak, Stephenson county, Ill.

—Press reports state that two adjoining bridges across the Blackstone river about one mile south of Millville, Mass., on the main line of the New England & Worcester division of the New York, New Haven & Hartford Railroad, were burned May 10. The structures were each about 120 ft. long, and cost about \$16,000. A steel bridge across the highway on the New England road was saved by the Blackstone fire engines.

—Contractor R. D. Shannahan of Portland, Me., has been awarded the contract for building the abutments for the new steel bridges on the Livermore side of the Androscoggin at Livermore Falls.

—Contracts for the 13 bridges over the Boston streets crossing the Providence division of the Consolidated Railroad have been awarded, a part to the Berlin Iron Bridge Co., and the remainder are divided between the Boston Bridge Works and the Pennsylvania Steel Co. Work on the steel contract is in progress. All of these bridges are to have solid metal floors of the pattern used on the Gaspee and Promenade street bridges in the Provi-

dence terminal improvements. This type of floor was patented by George B. Francis and Edward P. Dawley, of Providence, engineers of the Consolidated Railroad.

—Shepley, Rutan & Coolidge, 1307 Venetian building, Chicago, Ill., have the prepared plans for a stone bridge over the Parkway at Longwood avenue, Boston, Mass. The structure will have a span over Muddy River which will be 96 ft. long, the width being 60 ft., estimated cost, \$153,000. The plans have been approved by the Boston Park Commission and will probably also be by Brookline.

—Bridge building near Norristown, Pa., promises to be active this season, the largest one being that to be put up at Norristown. Of the others, one will span the northeast branch of the Perkiomen, in Lower Salford; one will cross the Wissahickon, in Whitpain; one will be erected over Towamencin creek, Towamencin township, and the other over Skippack creek, in Worcester. It is intended to let the contracts for all the bridges on June 17.

—It is reported that the county commissioners have decided to build a three-span iron truss bridge over Stony Creek R. R. and Stony Creek at Airy street, Morristown, Pa. The bridge will be 450 feet long, and is estimated to cost \$40,000. The structure will probably be erected this summer.

Buildings.

—The Cincinnati Forge & Iron Co. is going to build a plant at Carthage, near Cincinnati, that is to cost over \$100,000. The company has purchased for this purpose 20 acres of land and the plant will be one of the largest of its kind in the country. The buildings will be constructed of brick and iron and will include a forge and hammer shop, 350x120 feet; a rolling mill of the same size, and a machinery shop, 150x70 feet in size.

—It is stated that extensive new repair shops are to be built by the Boston & Maine R. R. Co. at Concord, N. H.

—Reports from Joliet, Ill., are to the effect that the Mississippi Valley Bridge Company, of Leavenworth, Kan., will locate in that place. A large plant, employing 300 men, will be erected.

—The foundations of the machine shop of the Stroh-McIntosh plant at Barberton, O., are completed. There will be three buildings, a machine shop, 40x100, two stories, a foundry 50x60, and an engine room 30x40.

—The Shelby (Ohio) Steel Tube Co. will erect three new buildings, one 130x70, one 100x105 and one 80x80. The company will also put in more powerful engines of the Corliss pattern and a number of new devices in the way of improved machinery for the production of cold drawn tubing.

—The Southern Pacific Railroad Co. has obtained a permit to construct a cotton shed at New Orleans, La., to cost \$15,000.

—The Columbia & Maryland Electric Railway of Ilchester, Md., has awarded the contract for the erection of the power house to S. H. and J. F. Adams, of Baltimore. The equipment will consist of four engines of 1,000 horse power each, connected directly with four electric generators, and five batteries of water-tube boilers of two 300 horse-power capacity.

—C. C. Woodruff of Pittsfield, Me., has secured the contract to build the round-house for the S. & M. R. R. at that place. It will be located near the Y, and will be of the same pattern as those of the Maine Central. It will accommodate three locomotives when completed. Work will be commenced at once.

—The district commissioners have under consideration the Baltimore & Ohio Railroad's viaduct plans for the terminal in Washington, D. C. The plans provide for a double viaduct of a solid structure of masonry, twenty feet in height, and of sufficient width at the widest point to give room for twenty-five railroad tracks; improvements to include a passenger depot, train shed 900 feet long and 180 feet wide, etc. It is said that the entire improvement will cost \$2,000,000.

—The Maine Central Railroad will erect, the coming summer at Skowhegan, Me., a large boiler and storage house. This will be used in heating the depot and the vestibule cars in winter, thus doing away with the all night service of a locomotive.

—It is reported that the Alabama Rolling Mill Co. (W. H. Hassinger, general manager) will build a steel mill at Gate City, Ala.

—John P. Jones, of Milwaukee, has been awarded the contract for building the new depot of the Chicago, Milwaukee & St. Paul Railway in Watertown, Wis. The old depot is being removed and work on the new one will probably begin next week.

—Messrs. Rawson & Morrison, Cambridge, Mass., are building a steel frame machine shop 60 x 150 ft. in size, two stories high, with asphalt roof and traveling crane. Power will be supplied from the present plant.

—The Western Maryland Railroad Company has awarded contract to John Cowan, of Baltimore, for the erection of a depot at Westminster, Md.

—The Wilmington (Del.) Malleable Iron Company advise that the two additions to its foundry will be 90 x 150 ft. and 65 x 75 ft. These additions are made with a view to increase the facilities for railway equipment and will double the company's output.

—The Midvale Foundry Co., Allentown, Pa., is erecting a new brick building 75 x 100 ft., one story high, for use as a molding shop, the present accommodations being too limited. The company has found business in architectural and machine castings, plumbers' and general castings very satisfactory.

Iron and Steel.

—The iron furnace erected at Decatur, Ala., by the Decatur Land Co., about seven years ago at an expense of \$111,000, has been sold to Nashville parties for \$20,000, and will be put in operation soon.

—The Daniels Steel Tie Company, of Youngstown, O., has received a second large order from the Terre Haute (Ind.) Electric Street Railway Company. This company placed a large order for ties several years ago and they gave such excellent satisfaction that more of them are now wanted to be used on an extension of the road.

—Another important test was made recently on the patent galvanized trough bridge floor of the Youngstown (O.) Iron and Steel Roofing Company. Two sections having a span of seven feet eight inches were loaded with pig iron and carried a load of 1,300 pounds per square foot without reaching the strength of the trough.

—Forty carloads of structural steel have been received at Houghton, Mich., for the new coal wharf of the Tamarack Osceola Company, and the first bent will be erected this week. The wharf will be ready for the receipt of 50,000 tons of soft coal this summer.

—The Weldless Steel Tube Company, recently organized, has secured options on 180 acres of land near Newark, O., and it is expected work on the erection of shops for the manufacture of weldless tubing will be commenced at an early date. Jas. E. Campbell, ex-governor of Ohio, is prominently identified with the new concern.

—The Vanderbilt Steel & Iron Co.'s 125-ton blast iron furnace at East Birmingham has been sold at public sale to John H. Blackwell and William H. Gaudy (bondholders of the company), who are said to have bought in their own right.

—The bids opened by the secretary of the navy on May 2, for furnishing the United States battleships "Kearsarge" and "Kentucky" with about 6,000 tons of nickel-steel armor, with the necessary bolts and nuts, and also certain hollow forgings, such as communication tubes, conning towers, etc. Part of the armor to be treated by the process of supercarbonization known as the "Harvey process," showed close figuring. The bidders were as follows: Bethlehem Iron Co., South Bethlehem, Pa.—for the "Kearsarge," \$1,573,390, and for the "Kentucky," \$1,569,750. Carnegie Steel Co., Pittsburgh, Pa.—for the "Kearsarge," \$1,568,162.50, and for the "Kentucky," \$1,572,477.50. This will result in giving the "Kearsarge" to the Carnegie company, and the "Kentucky" to the Bethlehem company.

—The Middlesborough Engineering Co. (Ky.) has been incorporated by English capitalists to buy the South Boston Iron Works. The company has a capital stock of \$500,000, of which \$150,000 will be retained as working capital, and the plant will be put in operation by July 1, manufacturing all kinds of heavy machinery. The plant is equipped for handling 30-ton castings, and two traveling cranes will likely be added in the near future. The operating company in Middlesborough will be organized under a different name, probably the Middlesborough Foundry & Machine Co. A. E. Manchester of Newburgh, N. Y., has been engaged to manage the business in America.

—The property of the Pennsylvania Steel Co., which went into the hands of receivers April 21, 1893, was transferred by the reorganization committee to the security holders at the annual meeting of the stockholders at Philadelphia, Pa., last week. The reassignment of the property and the transactions of the necessary legal requirements will occupy some time, and it is not likely that formal possession will be taken for some weeks. The report of Effingham B. Morris, chairman of the reorganization committee, which body has been acting as directors of the company since its reorganization, stated that the sales and deliveries during 1895 amounted to \$3,679,956. The net profits during the year were \$121,657. Among the directors who were elected is F. W. Hunnewell, of Boston.

—The Birmingham Rolling Mill Co., Birmingham, Ala., will engage in steel making, and has completed plans and let the contract for the building of two open hearth basic furnaces at its mill in the western part of the city.

—Frick Co., Waynesboro, Pa., has cast the largest cylinder ever made in this country. It weighs 14 tons and is for the big 350 ton Armour refrigerating machine.

—Anna Furnace, at Struthers, O., purchased last October by Runyon, Stubbs & Co., of Cleveland, from the Brown-Bonnell Iron Co., of Youngstown, O., for \$150,000 was turned over to them on May 1, as per agreement. The furnace was considerably improved last year and has a capacity of about 20,000.

—The Premier Steel Works, at Indianapolis, on which the DePauws have expended \$500,000, and which have been in the hands of a receiver since May, 1893, lying idle, have been leased to a syndicate, composed of the American Tin Plate Works at Elwood and the American Wire Nail Co., of Anderson, Ind., and within 60 days the new combination will begin the manufacture of steel billets, steel beams, and structural iron. The capacity for steel billets alone is 100,000 tons annually.

—The Colorado Fuel & Iron Co., of Denver, has been awarded the contract for 7,000 tons of new rails by the Union Pacific Railroad Company.

Machinery and Tools.

—A report from one of the steam shovels of the Vulcan Iron Works, Toledo, noticed in a recent issue, states that the shovel is working in a 10 to 14 ft. face, the dipper cutting through the ore as if it was so much sand, making 3 trips per minute, loading a car in 2 minutes, averaging 6 dippers to the car, doing the work easily and steadily. The

others were loaded as follows: 5 cars in 10 minutes, 6 cars in 12 minutes, 8 cars in 15 minutes and so on.

—The contract for the machinery for the four additional mills to be erected by the Elliott-Washington Steels Co., at New Castle, has been awarded to the Scaife Foundry & Machine Co., of Pittsburgh. Another 100 horse power Buckeye engine will be installed or the company may use the one that it now has lying idle which was taken out when the present 300 horse power engine was put in. Contracts for machinery, etc., are practically let. The new mill will be in operation by the middle of August and will be devoted to the production of high grade bright cold rolled strip steels such as is now being produced.

—The Davis & Egan Machine Tool Co., Cincinnati, is catching the eye of the average machinists with a small package of flax seed, put up in envelope easily fitting the vest pocket. The face of this envelope carries this legend: "Good Bye, Old Boy—Keep them clear by using our home grown flaxseed." This is followed by directions as to how to apply the seed to the eye for the removal of any small particle of foreign matter that may be giving pain.

—Mr. T. F. DeGarmo has been appointed as eastern representative of the Chicago Pneumatic Tool Co., with office in New York; and Mr. Wm. Mack, as western representative with office in Denver, Col. The company is shipping to Europe 300 machines of the largest size, and are arranging to open a branch office in London. It has also added to its line the Manning sand papering machine, which is meeting with great success, and has proven a great labor saver on coach work. Also the pneumatic car cleaner—for cleaning seats, upholstering carpets in the car, and converting the dust through the hose out of the window, and the Manning piston air drill which is an entirely new machine on the market.

Miscellaneous.

—The annual meeting of the stockholders of the National Switch & Signal Co., was held at its offices at Easton, Pa., May 12 at which time the old directors and officers were re-elected for the ensuing year. This company is to build an addition of brick and steel, 50x150 ft., to its signal plant at Odenweldertown. The new building will be used as the wood-working department and the space gained in the main building by the removal of the work of this department to the new building will be used by the electrical department. The company has been awarded the contract for installing two complete signal plants for the Troy Union at the terminal station at Troy. There will be a signal tower erected on a steel bridge spanning the tracks at each entrance to the station, which is a through station, and all the tracks within the station shed will be connected with multiple indicators in the towers and all the latest improvements in the art will be adopted.

—Mr. Mark A. Ross, who has been with the National Tube Works Co., of St. Louis, for several years, will after June 1, devote his attention to the sale of the National electric headlight, now handled exclusively by Royal C. Vilas, Monadnock block, Chicago.

—The use of the Pintsch light on railway equipment, and by light-house boards, is shown by the rapid increase in the figures on this subject. Over 70,000 passenger cars, 32,000 locomotives and 560 buoys are now lighted by Pintsch gas in various parts of the world. Its constantly increasing use on American railroads has been one of the greatest benefits ever enjoyed by the traveling public. The New York, New Haven & Hartford Railroad has extended the use of Pintsch gas to its buffet cars for heating the urns, it being found much cleaner and more satisfactory in the confined space in which the porter has to work. A specially constructed burner furnishes sufficient heat, while at the same time consuming but a small amount of gas. The Wabash Railroad is using a number of Pintsch gas ranges on its cafe cars, and is thereby enabled to serve hot meals at any hour of the day. This is a great improvement on the warmed-up canned meat menu of ordinary buffet cars, besides almost entirely eliminating the use of oil from the cars.

—H. McGaffey of Indianapolis has been awarded a contract to build four large water tanks on the Northern Ohio line. The Brice people are spending \$1,000,000 in extensions and improving their property.

—So well pleased are the officials of the Reading Railroad with the working of the Hall automatic signals recently erected along their lines that they have awarded contracts for the extension of the system from Jenkintown to Bethayres, on the New York division, and to Fort Washington, on the North Penn branch. The work is to be finished by August 1. Next year it is hoped to equip the New York division with the signals all the way to Bound Brook, when the entire New York route of the Reading will be thoroughly protected, as the Jersey Central Railroad already has a very complete signal system between Bound Brook and Jersey City. Including the work to be done this summer, the following lines of the Reading are operated under this system: The Atlantic City Railroad for its entire length, 55 miles; the lines to Germantown and Norristown, the North Penn branch as far as Fort Washington, and the New York division to Bethayres. These branches do the great bulk of the Reading's suburban business.

—During the past ten days the New York Belting & Packing Co. has taken orders for installing its interlocking rubber tiling on four steamers and one entire train of cars. The interlocking feature, making it absolutely impossible to displace the tiling, peculiarly adapts this material for use in all places where there is vibration, such as on steamers and railroad trains. Its durability, beauty and noiselessness recommend it for vestibules, aisles, corridors, hospitals, court rooms and other places where such features are desirable.